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TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

A. W. BORTHWICK, D.Sc.,
HONORARY EDITOR.

ROBERT GALLOWAY, S.S.C.,
SECRETARY AND TREASURER.

VOL. XXXI.

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VOL. XXXI.—PART I.

January 1917.

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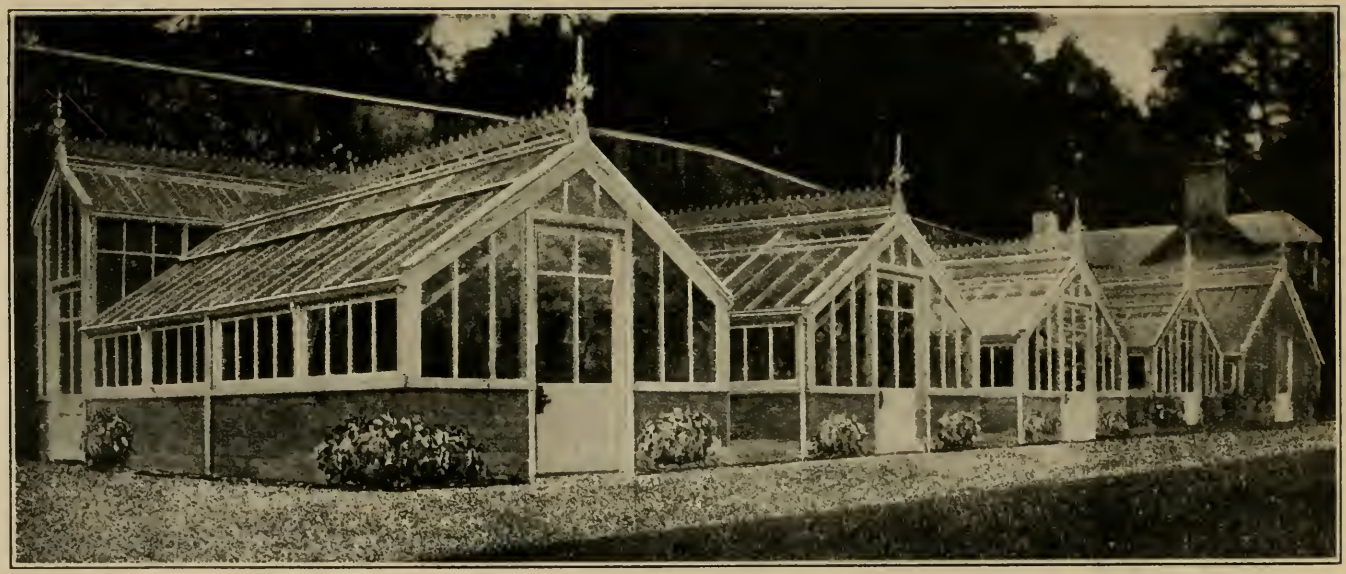

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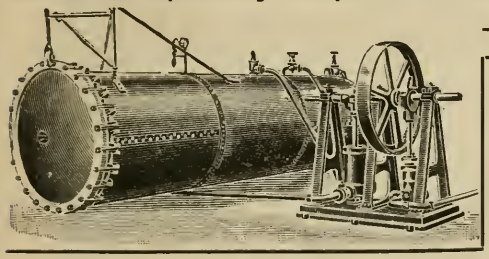

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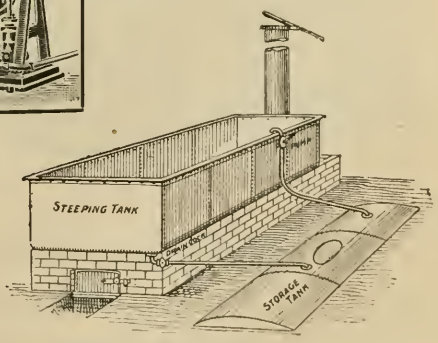

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TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

1. The Future of Forestry.[1]

By Sir Andrew Agnew, Bart.

I think we are justified in taking a more cheerful view of the prospects of forestry to-day than we have been able to do for a long time. Several things have happened since we last met here a few months ago, all of which have contributed to this more cheerful view.

In the first place, we have had the announcement that the Government are appointing a special Committee to deal with the subject of afforestation. We had this intimation direct from the Secretary for Scotland, who expressed the hope that the Committee would produce a bold scheme, and the belief that the Government would tackle it without delay. It is true that we have had committees before, and the result has not been such as to fill us with great enthusiasm. But circumstances have changed: and I think we may expect that, under the changed circumstances, the report of a committee of practical men is no longer likely to be ignored. Then there is the meeting that took place at the House of Commons a few days ago, between a deputation from our Society and the Scottish Members of Parliament. We laid before them our views regarding afforestation in general, but especially with regard to a separate Department for forestry, and they undertook to have the question discussed in Parliament before the close of the present session. Mr Galloway has drawn up a report of the proceedings at that meeting which will come before you presently; so I will say no more about it except this—that whereas we formerly had scattered sympathisers among the Scottish members, we now have a strong and united body who

[1] Presidential address delivered at the General Meeting of the Society, held on 12th July 1916.

are entirely with us, and who are not going to let the subject drop. But perhaps the ground upon which we may plant our hopes most firmly is the evident determination that, at the end of the war, something shall be done to render our country more self-supporting than it has hitherto been. During a long period of peace we have allowed ourselves to become dependent upon foreign countries for many things which we ought in future to produce for ourselves. A resolute effort, we are assured, is about to be made to develop our national resources more fully.

Now if there is one direction more than another in which our national resources are capable of development, it is in the production of timber. There is a large and obvious field here, and one from which a really valuable return is as certain as anything can be. Timber is one of the prime necessaries of our industrial life, and must always remain so. The amount of timber used in our principal industries, such as collieries, railways, and building trades, is enormous. The extent of it may be measured by the amount of timber we import annually to supplement our home supply. The year before the war, as you will all remember, the value of the imported timber was over forty million pounds. And while we spend this vast sum on foreign wood, we have millions of acres in Scotland which are not merely *waste* land, but *wasted* land. This land, which will grow nothing else, is admirably adapted for growing trees, and the very trees we most require. Ninety per cent. of the timber we import is coniferous timber; and every authority on silviculture, whether native or foreign, assures us that there is no country where the soil and climate are so well suited for coniferous wood as Scotland. All that is being obtained from this land at present is perhaps a shilling or two an acre for grazing purposes. If it were planted, it would before long yield many times its present rent, while retaining in this country, for the benefit of the nation, huge sums of money which now go into the pocket of the foreigner. The forests, as they grew, would become an ever-increasing national asset; and in any future emergency, such as that in which we find ourselves to-day, there would be no fear of a timber famine. The State would find in its own forests all the timber it required, and our industries would be carried on under normal conditions, undisturbed by panic or by panic prices.

I hope you will excuse me for dwelling on facts which are so familiar to you. I thought they might bear repeating at the present time, as there are still persons needing to be convinced. And I wished to emphasise, not merely my own conviction, but what I know to be the conviction of every member of our Society, that, when the war is over, and the Government begin to look about them for resources which are capable of being developed, they will find no opening more promising than that of afforestation, and no scheme which will more liberally repay any capital which may be expended upon it.

And while afforestation is desirable on its own merits, there is a special reason for carrying it out at the present time, and that is the opportunity it affords of settling returning soldiers on the land. The Government have introduced a measure for the establishment of farm colonies for the benefit of discharged soldiers and sailors, and one of these colonies is to be in Scotland. We shall all wish success to any such scheme. But for my part I believe that if the Government wish to create small holdings in Scotland on economic lines and with a certainty of success, they must do it in connection with afforestation. For the State, small holdings in connection with forestry would be the cheapest plan, since land bordering on the forest areas could be obtained at a far cheaper rate than land in the richer agricultural districts. For the small holder also it would be the best plan, and afford the best prospect of success. A small holder who has nothing to depend on but his agricultural holding must starve unless he can make profit enough out of his little farm to support himself and his family the whole year round. But in a holding on the edge of a forest he need only make enough to keep him for half the year, and he would be certain of regular employment at good wages for the other half.

I would refer to just one more reason for afforestation, and that is that along with forestry there would arise a number of new industries providing healthy employment, and retaining in the countryside thousands of workers who would otherwise be driven into the towns. Every one realises now that the first need of a country is a sound and vigorous population, and this can only be obtained by having a large proportion of the people living and working in the country. Afforestation would go a long way towards solving the problem in Scotland. What a

field we have for forestry and its attendant industries in the Highlands alone! We have heard many lamentations over the *de*-population of the Highlands: here is a unique chance for *re*-populating them. I trust the chance will not be allowed to slip. But if it is, I venture to say that it would be a discredit to the Government, as well as a real misfortune to the country.

2. Co-operation between the State and Private Owners for Afforestation of Barren Land.

By Captain Sydney Gammell.

The object of this short article is to put forward a concrete proposal, accompanied by some figures, for increasing the amount of forest land in the United Kingdom. I think it must be obvious to every one who has considered the subject that, if the formation of new forest areas is to be left entirely to the State, it can only be accomplished very slowly; and that, in order to get a more rapid increase in our home timber areas, the importance of which is now being so forcibly brought home to us, it will be necessary to enlist the services of many private individuals and corporations, and especially of the owners of large tracts of afforestable land. One hears people talking glibly of co-operation between the landowner and the Government for this purpose, but the difficulties are many, and only become apparent when one comes to definite proposals, and I am not aware of any proposals having been put forward which have found any favour with those whose interests are affected.

The proposals put forward here are in no way authoritative, and may be criticised as freely as possible. It is only in this way that any workable scheme is likely to come about. One criticism which I have no doubt will be immediately levelled at them is that they are too favourable to the owner of the land, and the fact that they are put forward by a landowner will perhaps be looked on as giving a handle for such criticism. May I be allowed to point out that the landowner, like a man in any other profession, must be considered as a business man, and that, like others, he is expecting, and is entitled, to make what profits he can by the investment of his money on prudent lines. Like any other business man, he cannot be

expected to spend money or forgo an appreciable amount of his income unless the prospects of a profit, either to himself or his heirs, are sufficiently attractive.

I have heard the argument put forward that a wealthy land-owner should be obliged by the State to plant such portions of his estate as will be best utilised in this way, but I would point out that, unless an owner of land has a large income from other sources, he is rarely to be termed wealthy or is in a position to do as is suggested, and this dictation as to what a man is to do with his money strikes at the whole root of the question of property in any form, and is not a subject that can be fitly discussed in a short article of this kind.

I think, then, that one is driven back on the plan of holding out inducements to the owner to co-operate both for his own and for the country's benefit, and it is with this in view that these proposals are put forward.

It is easy to say the owner must provide the land, and the State the cost of planting. But how? Is the land to be given rent free? is it to be subject to present taxation? is the State to find the money in the form of a grant or of a loan? how is it to be repaid if in the latter form? how are the proceeds to be divided? A host of other questions will have to be gone into before any such scheme can be put into action. I do not profess to treat the subject exhaustively, but to put forward some suggestions, which I trust will bear examination.

I may say at the outset, on the subject of taxation, that I would suggest that land brought under forest should be exempted from taxation, both local and Imperial, and that timber-growing should be treated as a business concern, and assessed for Income Tax under Schedule D. The exemption of the land would not cause a very serious loss in revenue, except in the case of Highland counties and districts which depend very largely on shooting rents for their assessments, and this in many cases would be only temporary, and should be reimbursed from Imperial sources. The stimulus and assistance this exemption would give to the formation of new forests should more than compensate the country as a whole for the temporary loss.

It is assumed throughout that the only land which should be taken for afforestation is such land as is not at present being put to an equally valuable commercial or economic use. There will be much opposition, I can foresee, both from the owners

and tenants of sporting properties, and from sheep graziers and flock-masters, but in my opinion both these should be overruled. A grouse moor or a deer forest, and more especially a rabbit warren, is about the most uneconomic use to which land can be put, and such use should be confined to land which has been proved incapable of anything else. Sheep grazing is little better. It is the least intensive form of agriculture, and produces less and gives less employment than any other form. It is really only suitable on a large scale for newly settled countries, and not for a highly civilised and intensively cultivated country such as ours. Some one may say, Is not this equally true of forestry? and I at once answer that this is not so. On land of the same quality it should produce, even at the low prices at which home-grown timber has been sold in these islands, at least double the value of produce per acre, while the labour it requires is very many times as great. This may be questioned, but if people will take the trouble to investigate the facts for themselves, I think they will find that I am right. The question of common rights—and this is also a matter of importance, as in England and Wales, at any rate, a considerable proportion of the afforestable land is common—will also have to be carefully investigated, and where it can be proved that forestry will give better results (from a national point of view) than the uses to which the commons are at present put, authority should be given by Parliament to use the common lands for this purpose, paying, if necessary, such compensation as may be found equitable.

Now to come down to the concrete proposals I am suggesting. It is almost impossible to deal with this subject in the abstract, and I have consequently made use of figures, which, although merely postulated, should not be found very far from the mark.

I have taken as a basis a grazing value for the land of 1s. per acre, and a sporting value of 6d. There are thousands of acres of land in the country which certainly bring in no more than this, and which would grow timber most satisfactorily. The timber value of the land need not be considered here, as it remains with the owner, though in any scheme of State purchase for the purpose of afforestation it is a very important question and must be taken into account. It can also be assumed that only land of good timber quality would be taken under such

a scheme as that outlined here, both landowner and Government expert having to be satisfied as to its suitability.

The cost of formation I have taken at £4 per acre, and if done on any large scale this should be ample. The crop is assumed to be Scots pine.

Now let us consider the terms and obligations on both sides, and how a forest formed on these lines should work out in practice.

The first thing to do is to decide on the area to be taken, and this should be done in large compact blocks; and if this is the case nearness to existing means of communication need not be a paramount consideration, as the value of the forest produce will eventually make it worth while to bring means of communication to it, though of course the geographical situation should not be lost sight of.

Say a practically continuous area of 1000 acres can be secured. The owner must be prepared to give this land free for the purpose, and if we assume the rent to be 1s. 6d. per acre he will then be depriving himself of an income from that source of £75 per year, which, on an estate on which there is only a narrow margin, is a serious consideration.

The scheme of planting, species, method, and all such considerations should be decided by the Government expert, and the Government must be prepared to put down the necessary money to plant it, which, assuming the rate of £4 per acre, will be £4000.

Now we come to the question as on what terms the Government should find the money. I would propose that it should be in the form of a loan to the owner, and should be at a low rate of interest, say 2½ per cent., and should be repayable by annual instalments after the fortieth year, the instalments to include compound interest for the whole period up to the final repayment of the loan.

The Government should have a lien over the crop as their security, and should have no claim against the owner as regards his personal or heritable estate.

It may be argued that this involves a risk which the State should not undertake, but I would point out that the owner is also taking his share of the risk in forgoing the rent of his land, and, unless the State is prepared to take some risks, it is very doubtful if anything can be done.

Let us now see how this will work out financially.

The Government will have lent the sum of . £4000
In 40 years this will have accumulated, with compound interest at 2½ per cent., to . . £10,740

I would then propose that the owner should repay this sum in twenty yearly instalments, with interest at the same rate, the timber being assumed to be now in such a state that it should yield profits, which should meet the annual instalments.

To repay £10,740 in 20 years, with interest at 2½ per cent., requires an annual instalment of £690

I think it should be in the option of the owner to pay off the balance of the loan at any time, but I do not consider it likely that this will be done. My idea is that the instalments should be met by sales of thinnings, and the above amount represents some 13s. 9d. per acre annually for 20 years, and should easily be met without damaging, and probably to the advantage of, the ultimate crop.

We have, however, to contemplate the possibility of the owner failing to make punctual repayment, and I would suggest that in this event the Government should be entitled to take the whole of the timber without further ado, repaying to the owner for that timber only such actual sum as he may have at that date paid towards the extinguishing of the loan. In this case, however, it would be necessary that they should take the land also on which the crop stands, so as to give them full liberty to deal with the crop to the best advantage, and should pay for it by a lump sum equivalent to the rent per annum for 40 years capitalised at 2½ per cent. In the above instance, this would be as follows:—

1000 acres at 1s. 6d. per annum £75
£75 per annum for 40 years, at 2½ per cent. . £5055

on payment of which sum the land would become Government property.

Let us now see, if we can, how the financial aspect of the proposition would work out, say, at the end of 80 years.

We must here assume again arbitrary figures, but good forest land at the end of 80 years should carry a crop of Scots pine of about 4000 cubic feet per acre.

This, at 6d. per cubic foot, = £100 per acre.

The total value of the timber should therefore be . £100,000
On the debit side, we must set—

(1) Loss of rent for the land (which, in this instance, we will calculate at 4 per cent.): 80 years' rent of £75 at 4 per cent. = £41,344

(2) Repayment of Loan—£690—
20 years at 4 per cent. = £20,546
Compound Interest on this sum for 20 years = 24,470
45,016

86,360

Balance credit £13,640

A point which has not been mentioned, but which has not been lost sight of, is the question of tending and management, and its expense. What it will actually cost is difficult to say, but, if taken in conjunction with other forestry operations, experience points to about 9d. per acre per annum as a fair figure to allow over the whole rotation.

This, of course, if capitalised would add a large sum, and would practically wipe out even the small profit shown; but I must point out, on the other hand, that no credit has been taken for timber taken out before the realisation of the final crop in the form of thinnings, and these should more than balance the expenditure. No doubt the first thinnings, 20 years and under, will probably be done at a loss, but between 20 and 40 years, and more especially after that time, the thinnings will be of considerable value, and should more than balance the loss in the earlier years. It is almost impossible to put this into figures, but I think most practical foresters will support me in what I have stated.

A further point which must be considered is, What is going to happen in the case of failure of the crop?

The crop may fail almost immediately, or at some later date, and I have put down two propositions and suggestions to meet these contingencies.

Suppose the crop fails and is manifestly not going to make a satisfactory forest, and this is realised within the first ten years. The cause of failure in this case may fairly be laid at the door of the Government expert, as it was presumed that his advice was to be followed as to the choice of species, method of formation

and such like details, and it is up to him to see the work properly carried out. If this is the case it would seem reasonable that the Government should bear the cost of making good, and that no part of this expense should fall to be repaid by the owner. I would point out that he will suffer quite sufficiently by the added lapse of time before the crop is at maturity, compound interest being charged against him during the whole of this period.

Failure, however, may be apparent at some later date, and it is not very easy to define what should be considered failure. I have come to the conclusion that it must be decided by the actual stand of timber on the ground at a specified date. If we take that date as forty years after the date of formation, if our expectations are to be realised, the amount should be somewhat as follows :—

If the crop is	Larch . . .	1000	cubic feet per acre.
,,	Scots pine . .	1200	,, ,,
,,	Spruce . . .	1800	,, ,,

These figures are somewhat arbitrary, but they are based on actual measurements and observations in this country, though the conclusions are by no means to be considered authoritative and may have to be considerably modified in the light of further investigation.

If the stand of timber fell below these limits, or such limits as can be shown to be reasonable, I would propose that the Government should be entitled to come in, cut the crop and sell it for what it is worth, and that the net proceeds should be equally divided between the Government and the owner of the soil. They would probably both be losers, the latter by the revenue he has sacrificed, and the Government by the difference between the amount expended and the amount realised.

I should perhaps state definitely that I have gone on the assumption that the owner does all supervision and bears the expense of it, but that he is entitled to all the produce during the growing period. I do not see how it can be done otherwise, but he would be obliged to do as he was told, and carry out all instructions by the Government supervisor, the Government reserving the right to enter on possession on similar terms to those provided for the case of failure in repayment of the loan, if their instructions were not obeyed.

It may be urged that even on an advantageous showing there does not seem to be much profit in any such scheme, but I would point out that this is a scheme for the formation of new forest areas, and cannot be expected to yield the returns of an old-established forest.

Once the forest area is formed its continuance is by no means an expensive matter, and it should be capable of producing a satisfactory net revenue in all time coming.

I have not gone into any of the national or indirect gains, important as these are, but have endeavoured, as far as possible, to treat the subject from an economic and financial point of view. I have no doubt these suggestions will be strongly criticised, but I have put them forward with this very object, and I shall welcome, and shall be glad to reply to any criticism which may assist in formulating any workable scheme for the afforestation of the bare land in these islands, of which, every one must agree, we have much too large an area.

3. Home-grown Pit-wood.

By Sir Kenneth Mackenzie, Bart.

One of the outcomes of the war may be the recognition by the British mining industry of the possibility of its demands for pit-props being met by the use of home-grown timber. It would therefore appear desirable for producers to consider whether they can meet such a demand and the best method of maintaining a supply.

In the past practically the only marketable product of British woodlands has been mature timber. This means a rotation of at the least sixty years, so that no individual lives to market the crop he has planted—a fact which has greatly retarded afforestation. While mature timber will still be in demand, and in all probability maintain its value, it seems quite possible by careful selection of site and genus to grow a crop of pit-wood which will give a good return in fifteen to eighteen years. The advantage of the short rotation to the grower is so obvious that no comment is needed, and its advantage to the nation by reducing payments to other countries for foreign wood is equally apparent.

It is believed that there are at least four different trees which can be grown in Britain that will give a crop of pit-wood in fifteen to eighteen years.

1. *The Black Italian Poplar.*—This demands a better soil than the coniferous trees, which are of rapid growth, and its employment for this purpose must depend on the annual value of the ground it is proposed to plant.

2. *The Douglas Fir* is most suitable for sandy soils and steep banks of deep sand, the grazing value of which is very small.

3. *The Menzies Spruce* while doing best on a fairly good soil can be grown with success on a very poor subject.

4. *The Japanese Larch.*—The writer has experimented a good deal with this tree, and believes that it is the most suitable of all for rapid rotation. It is quite certain that it grows well on slopes of any kind, and so far as his experience goes, a northerly aspect gives the best results. In a plantation with such an exposure, formed in 1905, a few trees were girthed in the summer of 1916. At $5\frac{1}{2}$ feet from the ground their circumference varied from $14\frac{1}{2}$ inches to 24 inches. These trees stand in rows 6 feet apart, $3\frac{1}{2}$ feet from one another in the rows. They have completely killed all undergrowth, and their annual leaf-fall appears to be adding considerably to the humus.

This plantation, which is small and which was only made for experiment, could be clean cut for props in fifteen years from date of planting, and give a very good return in interest on original outlay, and a much higher rent for the ground for that period, than the grazing value of the area planted, which was covered by bracken and was not worth more than 1s. 6d. an acre. To any who contemplate making plantations for pit-prop purposes, it may be said with confidence that all hill-sides that grow bracken will grow Japanese larch.

It is to be hoped that this question of pit-wood supply will not be overlooked when the woodlands that are now being cut down in Scotland come to be re-planted, for it seems certain that while a large area will need to be re-planted with Scots fir and larch for the production of mature crop, there will be many "odd corners" where a "catch-crop" of the nature suggested above can be taken over and over again, to the advantage of the whole community. It rests with the producers

of home-grown timber to see that they can satisfy the needs of the mines, for unless the demand for props can be met by a constant supply the consumers will be driven back to the oversea trade, with the result that the excellent market which has now been established for home-grown pit-wood will speedily revert to the pre-war standard of unremunerative inanition.

4. Continental Notes—France.

By A. G. Hobart-Hampden.

I.—French foresters are naturally thinking of how to repair the damage done to their forests during the war. The damage is due, either directly by the fighting, or by deliberate theft by the enemy, or by the heavy requisitions of the army— requisitions which, one gathers, often demand an exploitation exceeding the "possibility." The second cause makes our friends very angry, naturally, and they suggest that in the day of victory France shall be indemnified from the German forests.

While in France and Belgium the damage is principally direct, in Serbia, where the Austrians have been playing the same game, the indirect harm done may be even greater than the direct, by reason of the erosion which will result in this mountainous country.

The question of the species to be employed for the repair, and often complete re-wooding, of these forest areas is all-important. M. Jolyet thinks that in the main, and broadly speaking, Scots pine should be most used, because of its rapid growth, its comparative immunity from damage by frosts out of season, and its light cover, which will allow of the natural introduction of deciduous seedlings where there are deciduous seed-bearers at hand. But the species will not do everywhere, and has three special drawbacks, namely, its numerous enemies (insects and fungi), its defective growth in thin soils, and its imperious demand for light. The last would render it unsuited for filling blanks, except in the middle of very large blanks, more particularly when the trees surrounding the blanks are tall. So M. Jolyet suggests the Austrian pine (by the way, they want in future to call it the "black pine"), which has not these defects. Before proceeding we may remark that the Austrian does not

seem to have a wood of much value, and contains much sap-wood, and that while they are about it they might as well use its much superior cousin, the Corsican, though possibly (I am not sure on the point) it may not grow quite so well on very thin soils. This (to continue with M. Jolyet) is the great quality of the Austrian, especially over limestone ; and even on thin soils it will withstand storms. There are not many species that will do so in such conditions. Our author states that, though light-loving, the Austrian can stand a little cover in its youth, and, this cover removed, can go ahead, a thing which the Scots pine cannot do at all. This is a valuable quality, but in the present instance all that is required is the capacity to stand lateral shade, such as would occur in relatively small blanks. M. Jolyet thinks the Austrian could do this.

In discussing this matter, Gayer's "Classification of Species according to their demand for Light" is quoted, and as this is a useful table we will give it here. The order, then, starting with the most light-demanding, is as follows:—

1. Larch, birch.
2. Scots pine, aspen, willow.
3. Oak, ash, chestnut, mountain pine.
4. Elm, alder, Austrian pine.
5. White alder, lime, Weymouth pine, maple, Cembran pine.
6. Spruce, hornbeam.
7. Beech.
8. Silver fir, yew.

For dealing with smaller blanks, as for instance blanks caused by single shells, M. Jolyet regards the spruce as certainly the most suitable, but does not recommend it in places exposed to storms or drought. He is thinking of Central and N.E. France, which are very hot in summer. The danger from drought would, probably, be far less with us; indeed, a blank in a wood in Britain runs very little risk of it. With storms, of course, it is different. In such conditions it is the Austrian that is recommended. This species, besides the other qualities already mentioned, can stand great heat. Broadly speaking it will, in France, grow up to 400 metres, along a line following the limit of the vine, and, obviously, when the altitude is less the tree will grow farther north. This would seem to bring in at least the South of England.

M. Jolyet evidently regrets the disabilities of the spruce, and dreams of the formation of a new "race" of the species adapted to lower altitudes and rainfalls.

After all it is pure spruce woods that blow down so badly, and when spruce stems have grown up isolated from the start they adapt themselves to a considerable extent, and often resist storms fairly well. To some degree this fairly firm footing will, I am inclined to think, apply to individual spruce stems in a deciduous wood, and if care is taken not to isolate them in the fellings they will have the support of the surrounding wood.

So on the whole spruce should, generally, be quite a good species for filling small blanks, and in fact I use it for that myself—so far without mishap. Where the soil is very thin, and especially over limestone, *Laricio* should be substituted. For quite small blanks, when there is plenty of soil, silver fir (which M. Jolyet does not mention) seems indicated. Another tree I should think suitable (and am trying) for fair-sized blanks and in good soil is Vancouver Douglas.

II.—Observations made near Reims, at $7\frac{1}{2}$ kilometres from the front, in coppice woods containing introduced Scots pine, appear to show that the effect of the enemy's gas has been *nil* in the case of the deciduous species, but that the Scots pines have suffered badly. The principal gas attack was in October 1915, and in the following May the pines were showing signs of recovery. It is not clear whether there have been any gas attacks in this neighbourhood during the spring, but that would probably be a much more harmful time for the forest growth. Nearer the front the observations were, naturally, not so carefully made, but the deciduous species and the Austrian pines seem to have been uninjured, while the Scots pines were all yellow.

III.—The Morvan is a mountainous part of France, lying between the Seine and the Loire, and as roads did not exist in old times the streams formed the lines of export for the forest produce. These streams doubtless were not of a capacity to convey large timber, and so it came about that the material exported took the form of fuel, which went straight to Paris. Thus the treatment adopted was one suitable for producing fuel. It might have been ordinary coppice, but was in fact a sort of Selection in coppice forest, called "Furetage." Furetage simply consists in cutting those stems on a coppice-stool which have reached a certain size, returning for this purpose at intervals of

years. In the Morvan the species so treated (for the method still persists to some extent) is beech. Beech is not much of a tree to coppice, but still it does coppice, and is the best of fuel trees. A wood treated by Furetage must in time disappear if steps are not taken to prevent this, since the stools eventually lose their power of producing coppice-shoots. Attempts are made to remedy this by leaving a few standards to provide seed, but it cannot be much good, because seedlings can but rarely survive amidst a coppice growth. It would, however, be possible to plant seedlings of a certain size, and either grub up the surrounding coppice-stools, or regularly cut back the coppice-shoots that threatened the planted seedlings.

It seems possible that Furetage may be a method of value in places where poles are wanted for some special purpose. For example, in Kent, where hop poles are much used, a strongly coppicing species like chestnut seems specially indicated. Ash, too, is a great species to coppice, and, unless I am mistaken, is in fact used for hop poles. If this is so, it must be because the ash pole is easily obtainable, and also of a suitable shape, for the very poor durability of this wood when exposed must be much against it for such a purpose. Or are the ash poles, perhaps, creosoted?

One great point about Furetage is its absolutely rule-of-thumb nature, which would allow of any ignorant labourer working it, once the compartments were laid down and allocated to their several years of exploitation.

IV.—M. Emil Mer who, as we saw in the "Continental Notes" of January 1915, made experiments with spruce to ascertain the best degree of intensity to which to thin, has now given us most carefully compiled information in the same direction for the silver fir. Whereas the spruce crops he experimented on were young, those of silver fir were older, namely, 50 to 60 years old at the commencement of his operations so long ago as 1886. Two plots, A and B, were marked off and experimented on up to 1911. The stems were classified by girth, and the value of a tree of each girth-class established. A, which at the beginning contained fewer stems than B, was thinned to a heavier degree (*i.e.* percentage) than B, but since the latter plot had the greater number of stems the actual outturn from it was, in some of the thinnings, greater than from A. There were altogether four thinnings. The results from start to finish were

inconclusive as to actual outturn in volume, but the material produced by plot A was of considerably greater value. It seems a pity that the two plots were not equal in all ways at the beginning, and then thinned to different degrees, for this would have given clear results. But thinnings amongst conifers can easily be overdone, because too widely spaced stems will grow too quickly to produce good quality timber, and become too branchy, forming knots (that great defect), while there is danger of the exposed soil losing fertility.

V.—The question is often discussed of public bodies becoming forest proprietors, but one has rarely come across anything in this line quite so progressive as the action of the Peñarroya Society (or Company) in Spain. M. Laporte, one of the Algerian conservators, who himself saw what he describes, says that this is a very powerful company, owning numerous mines and factories for chemical products and manures. Formerly for mine props they had to go to Portugal and the Landes, and import them at great expense, now the company has created a forest "domain" of 12,500 hectares (one hectare is nearly $2\frac{1}{2}$ acres), and intends to extend it to 20,000 hectares. The forest lies on the southern slopes of the Sierra Morena, in the province of Cordova. This area is actually being afforested at the rate of 500 to 600 hectares a year. It costs 350 to 600 francs per hectare, and M. Laporte thinks that with the construction of houses and roads, supervision and interest on outlay, the figure might be put at 1000 francs per hectare (about £16 per acre). This is expensive, but M. Laporte says the work is being done by "intensive" methods, though what that means exactly is not stated. The results are marvellous. Maritime pine for pit-props, and eucalyptus both for props and for wood pulp, were planted. The latter, by a special method, is used for making sacks, of which an enormous quantity are wanted for their chemical factories. M. Laporte appears to have been writing in 1913, and he then found the pines planted in 1911 to be $1\frac{1}{2}$ to 2 metres (1 metre equals 3 feet $3\frac{3}{8}$ inches) high, and those of 1909 $2\frac{1}{3}$ to 3 metres high. The results for the eucalyptus were stupifying. Trees one-year old were between 3 and 4 metres high; those of 3 years 7 to 10 metres. Some *E. rostrata* in a nursery, in good conditions, had in 5 years reached 14 to 16 metres (some 50 feet), and about 25 inches girth. M. Laporte calculates that in 25 years there should be 33,772 cubic feet per acre, worth

£380! Using the figure of cost of 1000 francs per hectare, M. Laporte works out that the return would be 100 per cent. per annum.

Astonishing though these estimates are, they are supported by results obtained in Portugal, at Abrantes. A Mr William Tract (perhaps this is really the Mr W. Tait of whom these "Notes" made mention in January 1912) having lost his vines from *phylloxera*, planted 600 hectares of sandy ground, deep, but not fertile, with eucalyptus. The wood is now some 25 years old and the trees 30 to 50 metres high, and there are some 1200 stems to the hectare. This property is now valued at from £320,000 to £400,000. The Peñarroya Company in fact offers the former figure, while the proprietor holds out for the latter. Assuming that the cost of the work was 1000 francs a hectare (which is certainly too high), an outlay of 600,000 francs has in 25 years yielded 8 to 10 million francs.

It is not clear which eucalypts were used in the Peñarroya domain. Obviously the situation marvellously suits those which were used, but how can the soil fertility be maintained in pure eucalyptus forest, or even if the pines spoken of were mixed in? In such a blazing hot country a mixture with eucalyptus of some shade-bearing, soil-enriching species analogous to beech should have great results. Perhaps Spanish chestnut would do, for the shade of eucalyptus is very light. Obviously a dense undergrowth must react beneficently on the soil, and so on the trees of the overgrowth.

VI.—The Government forests of Rumania, without mentioning those belonging to the Crown, comprise 2,680,000 acres. They are very far from being developed; export lines are lacking, and they are neither demarcated nor surveyed. But they are submitted to an ambitious Forest Act, of which the terms are very strict. Practically all mountain forest, even private property, is, for protective reasons, placed under the charge of the Government Forest Administration, and disforestment is severely checked. There are rigid rules about grazing, and after a fire no grazing is allowed for 10 years—no doubt to stop the practice of setting a light to the forest to produce a crop of new green grass. There is, as in the Indian Forest Act, power to compound forest offences, a plan which in wild and undeveloped countries, where magistrates' courts are few and far between, is most valuable from a forest point of

view, and also diminishes hardship among such of the country people as forget to observe the forest law. The Rumanian Act reduces the taxes by half when a proprietor consents to have his forest worked on a scheme for the production of large timber. The Act makes provisions to enable the Government to buy up forest areas and unproductive ground with a view to reafforestation. If we at home are at the dawn of a proper Government forest policy such Acts as that of Rumania will be worth study.

VII.—The French have made a beginning of forest conservation in Morocco by sending over two forest officers and a score of forest guards. These got to work in 1914 in the region of Rabat, where there are said to be fine cork oak forests, notably one called "Mamora," and already in about a year they have put a stop to the ignorant devastation by the natives, who were accustomed to strip off the bark for sale to the tanneries of Rabat and elsewhere, and then to make charcoal of the trees. Now these same devastators have been taught to cut the bark (for cork) in accordance with the correct procedure, which of course provides for the continued life of the tree. In 1914 and 1915, 143,000 trees were worked, and 101 kilometres of fire-lines, 30 metres broad, were cut, and these also serve for roads. Much else, such as the building of quarters, has been done, and the infant Forest Service has in fact made a vigorous start. They think longingly of the fine cedar forests in the Atlas Mountains, but the political situation had not yet allowed them to get hold of these.

VIII.—It may be noted that Switzerland, before the war, imported wood pulp and cellulose, but has now discovered that, provided the price offered is a little more than that for fuel, she can supply herself. Everywhere we have been learning that it is better to trust to our own home supplies, and this matter of pulp and cellulose is yet another argument for the utilisation of our waste lands by afforestation. Incidentally it suggests the more thorough utilisation of the waste products of our woods, of which waste products one is inclined to believe that there are far more than is generally supposed. The case for afforestation ever grows stronger, but then, if it comes to that, it has been overwhelming for a long time.

5. Deputation to Scottish Members of Parliament.

A deputation from the Royal Scottish Arboricultural Society, consisting of Sir Andrew Agnew (President), Sir John Stirling-Maxwell (Honorary Secretary), Lord Lovat, Mr S. J. Gammell, and Colonel Steuart Fothringham (Members of Council), and Mr Robert Galloway, S.S.C. (Secretary and Treasurer), attended a conference with the Scottish Members of Parliament in the House of Commons on Tuesday, 4th July, at 5 P.M., with regard to the creation of a separate Department of Forestry for Scotland in connection with the Board of Agriculture for Scotland, and the promotion of forestry generally in accordance with the Council's Resolution and Memorandum of March last.[1]

The circular convening the meeting was signed by ten Scottish Members of the House, representing all parties. The Right Hon. E. Wason, M.P., presided, and amongst the Members present were Mr MacCallum Scott, Mr Mackinder, Mr Dundas White, Mr Watt, Mr Duncan Millar, Mr Pringle, Sir J. M'Callum, Mr Currie, Mr Barnes, Mr Holmes, Sir William Beale, Colonel Greig, Mr Murray Macdonald, Mr Molteno, Mr J. M. Henderson, Mr Cowan, Sir John Dewar, Sir John Jardine, Mr Macpherson, Mr Maclean, Mr Morton, Major M'Micking, Mr Hogge, Mr Adamson, Mr Dalrymple, Mr Allen, and Mr Falconer. Apologies for absence were intimated from Sir George Younger, Mr Whyte, and others.

The chairman extended a cordial welcome to the deputation and assured them of a very sympathetic hearing. He said that the Members present represented all parts of the country, and were all interested in the subject. They all felt that it was high time the matter of afforestation was taken in hand. The Government was cutting down and the Government should also plant. The Scottish M.P.'s, he was sure, would do their best to get the Government to take the matter up at once.

Sir Andrew Agnew thanked the chairman for the reception he had given the deputation, and also the Members for coming to meet them. He then submitted to the meeting the resolution which had been passed by the Council of the Royal Scottish Arboricultural Society:—"That it is necessary, in order to provide for the nation's future requirements of coniferous timber and such hardwood timber as can be economically

[1] See Vol. xxx., p. 100, July 1916.

grown in this country, and also to afford suitable and healthy employment for a large and ever-increasing rural population, that the Government should now create the promised Department of Forestry in connection with the Board of Agriculture for the development of forestry in Scotland, with an adequate annual grant for the purpose, and should instruct the Department to prepare without delay schemes of afforestation, combined with small holdings and other rural industries, to be put into operation as soon as the war is over, so that advantage may be taken of the unique opportunity when returning soldiers, sailors, and others are desiring work, to induce a proportion of them to settle on the land by offering them immediate and suitable employment in comfortable and congenial surroundings."

He said that he hoped that the Scottish Members would bring this matter before the House of Commons in the present session, and obtain some assurance from the Government with regard to it. They were forced to the conclusion that no real progress in afforestation could be made in Scotland without a special Department, whose duty it should be to attend to the subject, and that Department should be provided with a special fund to enable it to carry out its objects. The Development Commissioners and the Board of Agriculture for Scotland between them had provided several thousands of pounds for educational equipment and advisory work, but up till now little or nothing had been spent on planting in Scotland where the largest area of plantable land was situated. It was obvious when a Department had a number of subjects to attend to, the particular subjects which were sure to get precedence were those which excited public interest most. He was afraid that he could not claim that afforestation appealed very forcibly to public sentiment, but they were convinced that it was a matter of very great national importance, and if it continued to be neglected the country would have cause to rue it in the future. They felt that they must have a separate Department with a special staff to get forestry really attended to in Scotland. He had just had a interview with the Secretary for Scotland, Mr M'Kinnon Wood, who assured him that the Government were fully alive to the urgency of the question of afforestation, and had made up their minds to deal with it. The Government were appointing a Committee which was to inquire as soon as possible into the whole question throughout the country, and

he hoped the Committee would not take long in its deliberations and would propose some practical scheme. He (Sir Andrew Agnew) suggested that the great anxiety of the Society was to have a separate Department, but the Secretary for Scotland said that something larger must be done, and that some big practical proposal would be made which would do away with the necessity of the appointment of a Department of this kind. This was a matter on which they would like to have an assurance from the Government in the House of Commons.

Lord Lovat, who followed the President, said that he wanted to emphasise three points—(1) The necessity for a separate Department; (2) for a survey by which they might be able to learn the exact number of acres suitable for planting in Scotland, and a detailed survey of the most suitable places for afforestation; and (3) the encouragement of planting by the State. The landowner had the land, the experience and the men, while the State had the money. He reminded the meeting that up till now the whole of the planting had been done by the private landowners. All interested should now be encouraged to co-operate in the work of afforestation. He wished to deal with the Highlands. There he hoped that the State would come forward and take a position in the afforestation of Scotland similar to what had been done by the State in other nations. The driving power of forestry which would make an appeal to the people of the country was that it was the cheapest way of settling more people on the land. It was the cheapest way, because every single individual whom they would put down in connection with afforestation in these glens of the Highlands would be a definite addition to the population, and no one would be displaced. By forestry they would get one man set on the land immediately for every hundred acres planted, and after a short time they would get one man settled on every 25 or 50 acres. They could purchase suitable land on places of the West Coast at from £2 to £3 an acre, and they could plant it at a cost of from £3 to £5 an acre, and they thus would get an individual settled on the soil at an original capital expenditure of something like £1000. The cost of settlement by small holdings was two or three times more than this. The land suitable for afforestation in the Highlands had been placed as high as 4,000,000 acres. He did not think it was as much, but it was certainly not less than 2,000,000 acres, on which it would be

possible to put men down in the proportion of one man to every 100 acres. There was no industry which worked so well as forestry in connection with small holdings. The seasonal labour of agriculture and forestry fitted in well, and he thought a fine healthy life would be opened up to men engaged in this employment.

Sir John Stirling-Maxwell said that although the social side was likely to be the driving power in the movement for afforestation, it had another side, the purely business side. This country really stood in need of large supplies of timber of its own. It had been argued that the supplies of timber were becoming more precarious because the world's supplies were becoming exhausted. These prophecies, made thirty years ago, had come absolutely true. Taking soft-wood, such as that of conifers, which they were able to produce in Scotland, and of which the country imported a very large quantity, the price had risen between 1895 and 1913 by as much as 33 per cent., and the sources from which that soft timber had come had gone through a very remarkable change. In 1895, 22 per cent. of our total imports of timber came from within the Empire. In 1913, this percentage had fallen to 10 per cent. We were more dependent than ever on foreign countries. It might be well if the House of Commons was to get some estimate formed as to what the result to the country had been through not having adequate timber supplies of its own during the time of the war. On this point there was ample evidence to support the contention which the deputation was now bringing before the Scottish members.

Mr Dundas White asked the deputation what was the basis of valuation suggested for the acquisition of land, and whether they thought it should be by purchase or feuing.

Sir Andrew Agnew replied that that was a matter which they would have to consider, but they had not got quite so far as that yet. In the meantime, their object was to get the principle accepted, and they thought it was premature to discuss the methods by which the scheme could be carried out.

Sir John Stirling-Maxwell said it was obvious that, provided the land was suitable, the right policy was to plant the cheapest land. It was a great thing to have large blocks to allow of the use of light railways. As regarded tenure there was no

doubt that the best plan for forestry was purchase, that was to say that the land should belong to the person planting it.

Mr Dundas White—"Would you exclude feuing?"

Sir John Stirling-Maxwell—"No, I would not. The French and Germans invariably purchase, but I would not rule out other methods. But I think the methods of acquiring land cannot be too simple. The present methods by which land has been obtained are very cumbrous." He suggested that there should be a very simple form of inquiry by a body in which every one had perfect confidence.

Mr Duncan Millar asked whether the Society had ever discussed the methods with the Development Commissioners.

Sir Andrew Agnew said that on more than one occasion they had discussed the matter informally with the Development Commissioners, but they had not come to any decision. Their views, however, were well known to the Commissioners.

Mr J. M. Henderson said that the war had opened the eyes of the country to the position of timber. He was sure that they could get a great number of men put on the land in connection with forestry, and if they followed auxiliary occupations they would get a decent living. He complained of the past action of the Development Commissioners in declining to purchase land for afforestation. A country like this, he maintained, ought to have more forests even if they cost much money. He believed that, properly managed, it would be a paying proposition.

Mr Currie said with regard to the question of how the land was to be acquired by the Government, they could not expect the House of Commons to go far forward in this scheme unless they could have something definite on that point.

Mr Cowan said he would like to be satisfied that the creation of a new Department of Forestry was going to make it easier to re-afforest Scotland.

Sir Andrew Agnew replied that under the present system afforestation was neglected in Scotland, and they thought that in these circumstances there should be a Department whose sole business it was to attend to afforestation.

Mr MacCallum Scott asked if the Society was aware of the valuable work being developed by the Middle Ward of Lanark for training disabled soldiers in connection with the afforestation operations at Hairmyres and Camps, and was

informed that the Society was in full sympathy with the Local Authority's proposals.

Sir John Dewar, in proposing a vote of thanks to the deputation, said the question was of pressing importance. A very large area of forest had been cut down in Scotland. The deforested land was owned by men who, in many cases, had not the resources to replant it, and it would be a great loss to the country if it was not replanted. He did not see why landlords in Scotland should not be paid in Stock for land. The deputation might depend upon it that the Scottish members would not again look at the Lands Clauses Act. If the landlords came forward and said they were prepared to give the land on fair terms it would go a long way, but landlords would find that deer forests would not let so easily in the future as in the past. If the landlords of Scotland were prepared to take the present value of the land as a fair basis, he did not think there would be very much difficulty in getting something practical done in this matter. A separate Department was needed.

Mr Molteno seconded the motion, and Sir Andrew Agnew having briefly replied, the proceedings terminated.

6. *Hylastes cunicularius*, Er., and its Relation to the Forest.[1]

(*With Plate.*)

By James W. Munro, B.Sc.(Agr.), B.Sc.(For.).

Introductory.—Three members of the genus *Hylastes*, Er., may be said to be of economic importance in our Scottish woodlands, namely, *H. ater*, Pk., *H. palliatus*, Gyll., and *H. cunicularius*, Er. The first two species have for long been known as two of our commonest bark beetles. *H. cunicularius*, on the other hand, has hitherto been overlooked, probably owing to its close resemblance to *H. ater*.

Of the habits and life-histories of all three species our knowledge is scanty, and is largely derived from the German literature. Owing to the fact, however, that our Scottish

[1] Reprinted, after revision by the Author, from *The Scottish Naturalist*, Nov. 1916. We are indebted to Messrs Oliver & Boyd for the loan of the accompanying blocks.—Hon. Ed.

forest conditions are markedly different from those prevailing on the Continent, it is essential that we should study our forest insects afresh from that aspect. The following paper is a short account of observations on *Hylastes cunicularius* made in the field under forest conditions that are, unfortunately, all too prevalent in Scotland.

MATERIAL.—The material for the comparison of *cunicularius* with its congeners is based, partly on specimens taken at Skene, Aberdeenshire, in 1914, and partly on specimens collected on Darnhall Estate, Peeblesshire, during 1915-16. These specimens have been submitted to the British Museum, and the identity of the species has been confirmed there.

The materials for the illustration of the life-history and of the injuries caused to young plantations by *H. cunicularius* were obtained on Darnhall.

THE ADULT.—As I hope, in a later paper, to deal with the genus *Hylastes* more fully than is possible here, I can best describe *H. cunicularius* by contrasting it with its more common congeners, which are familiar to most naturalists interested in the Coleoptera.

The essential features distinguishing the three species are the configuration and sculpture of the thorax. The following table gives the characters of each species. Plate I. fig. 2 illustrates the configuration of the thorax in each. It is a familiar figure in the continental text-books, and my only excuse for introducing it here is its usefulness. The specimens from which I have drawn it are all Scottish.

Character	*H. ater* (*a*)	*H. cunicularius* (*b*)	*H. palliatus* (*c*)
Thorax . .	Sparsely punctured on disc, sides sub-parallel. Oblong elliptical, longer than broad.	Evenly punctured throughout, sides rounded. Roundly elliptical, as broad as long, but varying slightly.	Evenly punctured throughout, sides tapering anteriorly. Blunt-pear-shaped. Broader than long.
Colour when Mature.	Black, shining.	Dark brown to black, dull.	Brown to dark brown.
Length . .	4-5 mm.	$3\frac{1}{2}$-5 mm.	$2\frac{1}{2}$-4 mm.
Usual Breeding-host.	Scots Pine.	Spruce.	Spruce, Scots Pine and occasionally Larch.

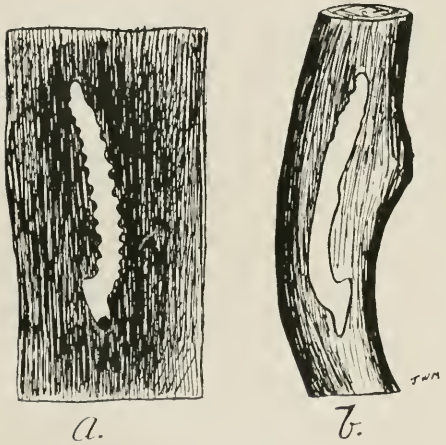

FIG. 1.

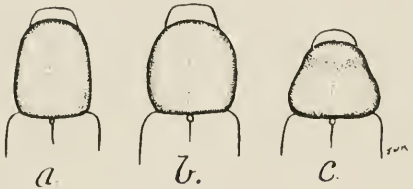

FIG. 2.

FIG. 3.

To face p. 26.

For Explanation see text, p. 30.

From the table on p. 26 it will be seen that *H. ater* and *H. cunicularius* are very similar. The sparse puncturing on the disc of the thorax in *H. ater*, however, causes the thorax to appear shiny, and this feature, together with the more elongate appearance of the beetle, is a most useful character for distinguishing *H. ater* from *H. cunicularius* in the field.

The Egg.—The egg of *H. cunicularius* does not call for any special notice. It is oval in shape, shining white in colour, and shows neither sculpturing nor micropyle. It does not differ from the usual scolytid type of egg.

The Larva.—The larva of *H. cunicularius* is of the typical scolytid type, a curved, whitish, legless grub with yellow head and biting jaws.

The Pupa.—Except in the distinctly oval shape of the prothorax, the pupa of *H. cunicularius* does not differ markedly from that of the other members of the genus.

The Brood Gallery.—The "Brood" or "Mother" gallery of *H. cunicularius* is typical of the species. It conforms to the *Hylastes* type in being crutch-shaped. Its distinctive features are its breadth, its shortness, and the short equal arms of the crutch. Its shortness contrasts it with that of *H. ater*, which is long and narrow, and the equal arms of the crutch contrast it with that of *H. palliatus*, in which (and this is also a feature of *H. ater's* gallery) one arm of the crutch is invariably considerably longer than the other.

The "crutch" is the so-called brood chamber. It is the first portion of the gallery to be cut. In it the male is usually found while the female is cutting the mother gallery proper.

Figure 1 is a sketch of a typical *cunicularius* brood gallery cut in a spruce root, half an inch in diameter. It shows the typical small crutch, which in the gallery figured is slightly deflected (a very common feature), and the egg niches, which are invariably cut in the bast and bark. The black circle at the foot of the gallery is the entrance, while *a* shows the gallery as cut in the bark, and *b* its counterpart on the root itself. In *b* it will be seen that the egg niches are absent and that the shape of the gallery is much less definite.

The Larval Galleries.—The larval galleries arise at right angles to the mother gallery, from the egg niches. At first they are distinct, but this is only for a very short distance, as they

soon become confused and ultimately form a large cavity gnawed in the bark. Later on, however, they may emerge again to end in well-defined pupating pits or chambers.

HABITS.—*H. cunicularius* is essentially a soil-dweller, breeding in spruce roots just below the soil level. It prefers roots from half an inch to two inches in diameter, but also breeds on larger and smaller roots.

Its "feeding" ground, which is distinct from its breeding ground, is the young coniferous plantation. Here, if the beetles are newly emerged and sexually immature, they feed to develop their reproductive faculties ("reifungs-frass") or, if mature, to recuperate after their first breeding period ("ernährungs-frass"). It is this "feeding," or "frass," which makes *H. cunicularius* the enemy of the forester. It attacks young, recently-planted conifers just below the root-collar, gnawing away the bark, girdling the root-stem, and by preventing the sap-flow causes the young trees to wilt and die.

Figure 3 shows the lower portion of a young (four-year-old) Scots pine destroyed by the adult *cunicularius*. On the plant from which Fig. 3 was made five *H. cunicularius* and two *H. ater* were feeding. The gnawed portions of the young plant are unshaded in the figure.

Often *H. cunicularius* is accompanied by the large pine weevil, *Hylobius abietis*, L., which gnaws the bark of the young plant *above* ground. In fact, so common is this association of *H. cunicularius* and the weevil that, until recently, I was inclined to consider the Scolytid was a follower of the weevil, which is much the more common beetle and is, in fact, our worst forest pest. That *H. cunicularius* is, however, primarily destructive I have now abundant evidence.

RELATIONS TO THE FOREST.—The relations of *H. cunicularius* to the forest can, I think, best be illustrated by the description of an attack by it.

On 7th October 1915, on Darnhall Estate, Peeblesshire, I observed *Hylastes* damage in a young plantation of Scots pine, larch and spruce, and obtained *H. ater* and *H. cunicularius* at work. Adjoining this plantation a small area of woodland, consisting of spruce and Scots pine, in which the spruce predominated, had been and was still being felled. During the spring of 1916, this smaller area was planted up with four-year-old plants of Scots pine, larch and spruce.

It is on this newly-planted area that my observations have been made.

I believe it to have been infected from the larger, older plantation on which I first observed *Hylastes* at work in October 1915, for at that time out of seven stumps examined only one yielded *Hylastes* (and only three specimens at that), all being *H. ater*.

In 1916, the youngest plantation was badly infested, and in August one-third of the young plants had been destroyed, chiefly by *H. cunicularius*. Further, the spruce stumps on the area yielded numbers of *H. cunicularius* larvæ, pupæ and adults, while a few showed galleries containing eggs with the females still at work. The Scots pine stumps, only about twenty in number, yielded *H. ater*. These facts lead me to believe, as I have said, that the area was infected from the larger, older plantation, but how it was infected I have not been able to discover.

The plantation then under observation consists of an area full of spruce stumps and roots. Now it is a feature of the spruce that it is shallow-rooted. Its roots do not go deeply into the soil, but extend for long distances just below the soil surface and are often exposed at certain points. On these roots *H. cunicularius* must occur in hundreds. I have taken adults on a portion of a root fifteen feet distant from its source at the stump. In this network of infected roots the young conifers have been planted, and the wonder is, not that half of them will probably be destroyed before the year is out, but that any should survive.

One most interesting feature of this attack must be noticed. After the area in question had been completely felled, the forester took the precaution of burning all the brushwood on the top of the stumps, thus charring them and the exposed portions of their roots considerably. As has been shown, this charring has proved of no avail. The gallery illustrated in Figure 1 occurred only half an inch distant from a badly-charred section of the root.

This failure of a much discussed preventive measure is extremely interesting. At first sight it would seem to indicate that the measure is useless. I am not inclined to make so sweeping an assertion, but I believe rather that charring is useless unless carried out just prior to, or better still, during the

breeding period of the beetle, that is, in early April or May according to the weather conditions prevailing.

Conclusion and Summary. — *Hylastes cunicularius*, Er., undoubtedly breeds in Scotland, and may prove to be more common than we at present believe.

It is essentially a spruce-dweller, breeding below soil level.

It feeds in the roots in which it was reared, but if opportunity offers migrates to young coniferous plantations, where it feeds on spruce, Scots pine and larch. Its life-history and habits are strikingly similar to those of *H. ater*, Pk., but owing to the branching of the roots of its breeding host, the spruce, it is probably a more formidable enemy of young trees planted in old spruce clearings than *H. ater* proves in similar pine clearings.

In the larval stage *H. cunicularius* is harmless. The adult, on the other hand, injures or totally destroys newly-planted conifers of various kinds. Spruce, Scots pine and larch have been found attacked by it. In the areas under observation, the loss caused by *H. cunicularius* may be stated as not less than a pound per acre, allowing the cost of planting to be three pounds per acre, a low estimate.

In conclusion, I wish to express my indebtedness to Mr Chalmers, Overseer, Darnhall, for his kind permission to make observations and collect material in the woods under his charge.

Explanation of Figures on Plate I.

Fig. 1. Mother gallery of *H. cunicularius*, Er., on spruce root: (*a*) gallery cut in bark showing egg niches; (*b*) gallery shown on root.

Fig. 2. The thorax in *Hylastes*: *a* = *H. ater*, Pk.; *b* = *H. cunicularius*, Er.; *c* = *H. palliatus*, Gyll.

Fig. 3. Lower portion of young Scots pine, showing "frass" of *H. cunicularius*.

7. Forestry and Income Tax.

The Finance (No. 2) Act, 1915, Section 22 (4), provides that, in future, occupiers of woodlands shall pay Income Tax under Schedule B on the full rental as appearing in the Valuation Roll, in place of on one-third of that rental as formerly. It also provides that any occupier, who proves to the satisfaction of the General Commissioners that his woodlands are managed on a commercial basis with a view to the realisation of profits, may elect to be charged under Schedule D instead of under Schedule B, subject as follows:—

(*a*) Any such election shall extend to all woodlands so managed on the same estate; and

(*b*) The election shall have effect not only as regards the year of assessment mentioned in that section (18 of the Customs and Inland Revenue Act, 1887), but also as respects all future years of assessment so long as the woodlands are occupied by the person making the election.

Section 18 referred to is the section giving the option to farmers to be charged under Schedule D, and providing for notice either to be delivered personally or by registered letter to the Surveyor of Taxes within two calendar months after the commencement of the year of assessment. After receipt of the notice the charge upon the farmer to the duties of Income Tax for such year shall be under Schedule D, and his profits or gains shall be considered to be profits or gains of a trade chargeable under that Schedule. The difference between the farmer and the arboriculturist in making this election is that the farmer's election stands for one year only, whereas the arboriculturist having once made the election must stand by it as long at he occupies the woodlands.

It has now been ascertained that the income from woodlands managed on a commercial basis will normally be regarded as "earned" income, whether assessed under Schedule B or under Schedule D, and will be entitled to reduced rates of tax where the occupier's total income does not exceed £2500.

The Council had an opportunity of considering and making suggestions on the draft form of Account prepared by the Inland Revenue before it was finally printed off. Copies of

the Form of Account may now be obtained from any Surveyor of Taxes.

The provisions of the 1915 Act, quoted above, did not meet with the approval of the landowners, and several amendments were proposed in the course of discussion on the Finance Bill of 1916, with the object of securing better terms for the encouragement of planting. The Government ultimately submitted an amended clause, which was readily accepted, and it now stands as Section 38 of the Finance Act, 1916, and is as follows:—

"(1) Any person occupying woodlands who proves to the satisfaction of the Special Commissioners that those woodlands are managed by him on a commercial basis, and with a view to the realisation of profits, shall have the same right under Subsection (4) of Section twenty-two of the Finance (No. 2) Act, 1915, to elect to be charged under Schedule D, as a person who proves those facts to the satisfaction of the General Commissioners, but an application to prove those facts in any year in respect of the same woodlands must be made either to the General or Special Commissioners, and not to both.

"(2) Paragraph (*a*) of Subsection (4) of Section twenty-two of the Finance (No. 2) Act, 1915 (which provides that the election shall extend to all woodlands managed on the same estate), shall not apply to woodlands which are planted or replanted after the passing of this Act, if the person occupying those woodlands gives notice to the General or Special Commissioners, within a year after the time when they are so planted or replanted, that they are to be treated for the purpose of that paragraph as being woodlands on a separate estate.

"(3) Section twenty-three of the Customs and Inland Revenue Act, 1890 (which gives relief to trading persons in case of loss) shall, where a person occupying woodlands has elected to be charged to Income Tax in respect of those woodlands under Schedule D, apply to losses on those woodlands as it applies to losses in any trade."

The meaning of the foregoing clause will be better understood by a reference to the Parliamentary Debates, but the following short extracts from the official report may serve the purpose:—

Captain Bathurst, after expressing gratitude to the Chancellor of the Exchequer for moving such a generous clause, said: " . . . With regard to Subsection (2) I understand that it is inserted in response to an appeal made to the Chancellor of the Exchequer in Committee, and also yesterday, to exempt, as far as possible, all new plantations from taxation. I understand it will now be possible for any person who plants land freshly with trees to take that portion of his estate and treat it for the purpose of Income Tax as though it were a separate estate altogether, and that if he elects to be taxed under Schedule B in respect of the bulk of the estate it will be possible for him to ask to be taxed under Schedule D in respect of that portion of his estate. That is going a long way to encourage landowners, as far as their means permit, to take part with the State in afforesting a large area of land. . . .

"As regards Subsection (3), which is quite new as far as this sort of property is concerned, it looks as if it might prove to be a very valuable concession. What I want to know is this: Supposing in any one year, owing to larch disease or serious gales, a large amount of timber suffers loss or destruction, will it be possible to bring into account the loss upon that timber, after a careful valuation, as against a profit that may be derived during the same period from timber that is felled, and has its full commercial value? If I read the Subsection aright, that is what is contemplated, but it is a point upon which I should like some guidance, because it is the sort of thing that happens frequently. In a wind-swept country, where a good deal of planting goes on, you may get a large portion of a large plantation laid low in a single night. That happened last March in many parts of the country. I want to know whether in conditions like that, either the present or prospective loss resulting from such abnormal conditions can be brought into account in reckoning whether the tax-payer is to be assessed up to the full value of the profits he derives from the other parts of his woodlands? . . ."

Mr M'Kenna in reply said: " . . . Subsection (2) enables the tax-payer to treat a newly planted part of his woodlands

as a separate estate for the purposes of assessment. It gives him the option of applying Schedule B of the Income Tax to one part of his estate and Schedule D of the Income Tax to another part of the estate. It is, of course, a very valuable concession that is given, not primarily as a relief to the tax-payer, but in order to encourage afforestation. . . . What we intend by Subsection (3) is to give the owner of woodlands precisely the same advantage which is given to the trader. Supposing a landlord spends money upon developing woodlands and that money is all lost, and does not give him any advantage, he may treat it as a loss, just as the trader would treat it as a loss. . . . It does not bring him the appropriate advantage. He spends money on his woodlands and expects to get a return. He does not, and he will treat that expenditure as a loss just as a trader would. The other descriptions of loss which the hon. gentleman has mentioned would be treated as a loss without this clause. They would be loss in any event. . . ."

Section 23 of the Customs and Inland Revenue Act, 1890, referred to above, is as follows:—

"(1) Where any person shall sustain a loss in any trade, manufacture, adventure or concern or profession, employment, or vocation carried on by him either solely or in partnership, or in the occupation of lands for the purpose of husbandry only, it shall be lawful for him, upon giving notice in writing, to the Surveyor of Taxes for the district, within six months after the year of assessment, to apply to the Commissioners for the general purpose of the Acts relating to Income Tax for an adjustment of his liability by reference to the loss and to the aggregate amount of his income for that year, estimated according to the several rules and directions of the said Acts.

"(2) The said Commissioners shall, on proof to their satisfaction of the amount of the loss and of the payment of Income Tax upon the aggregate amount of income, give a certificate authorising repayment of so much of the sum paid for Income Tax as would represent the tax upon income equal to the amount of loss, and such certificate may extend to give exemption or relief by way of abatement in accordance with the provisions

of the said Acts. Upon the receipt of the certificate, the Commissioners of Inland Revenue shall cause repayment to be made in conformity therewith."

Excess Profits Duty.

On this subject the Secretary of the Board of Agriculture and Fisheries, London, under date 28th January 1916, wrote as follows:—

"Sir,—I am directed by the President of the Board of Agriculture and Fisheries to inform you that he has been in communication with the Chancellor of the Exchequer on the subject of Excess Profits Duty on timber, and that Mr M'Kenna has authorised him to state that even if the provisions of the Finance Act (No. 2), 1915, which deal with Excess Profits Duty apply to the profits derived by landowners from the sale of their timber, it is agreed that in the case of 'commercial' woodlands assessed to Income Tax under Schedule B, the profits for the purpose of Excess Profits Duty shall be taken to be the amount assessable under that Schedule.

"In the case of woodlands which are not run on 'commercial' lines, there would be no trade or business and the question of Excess Profits Duty would therefore not arise.

"The effect is that landowners who at the present time are willing to meet the national demand for timber by largely increasing their felling and sale of timber, can continue to be assessed for Income Tax under Schedule B on an annual value and run no practical risk of liability for Excess Profits Duty."

R. G.

8. The State Nurseries and Plantations of New Zealand.

The annual report for 1916 of the Forestry Branch of the New Zealand Department of Lands and Survey contains, as usual, a large amount of interesting information and a fine record of useful work done.

The number of trees raised during the year with which the report deals is given as 9,122,000, all raised at the four State nurseries of New Zealand. The number of trees sent out to the various State plantations during the same period was 5,485,450, while to outside places 410,050 plants were consigned. In six plantations where planting land was still available, a total area of 2677 acres was planted.

The expenditure for the year was £30,415. The year-book for 1915 shows that the annual expenditure, as at 31st March 1915, averaged for nurseries £9700, and for plantations £19,000. The same year-book shows that a total area of 24,563 acres had been planted in eleven plantations. This, together with the 2677 acres mentioned above, gives a total of 27,240 acres planted to date.

The State gives assistance to farmers who plant trees, and the facilities offered are taken advantage of to a large extent. The object which the State has in view in encouraging farmers to plant trees is on account of the great value of shelter plantations, and also on account of the increasing scarcity and enhanced prices of fencing material and fire-wood. It is not expected that the planting of trees for farm purposes will add appreciably to the supply of building and other constructional timber. The Department clearly realises that if the State is not to be dependent on foreign countries, it must itself supply the timber necessary for these purposes, aided possibly to some extent by public bodies who may find it an advantage to grow timber trees on water-catchment areas.

The thinnings from the larch and pine plantations are already finding a satisfactory market, but, owing to the as yet comparative abundance of native timber suitable for mining props and sleepers, and the easy terms on which these can be obtained from State lands, the mining companies are generally disinclined to take larch thinnings. The supply of suitable native timber is, however, fast decreasing, and probably the day is not far

distant when thinnings from plantations will be much sought for by the mining companies.

Apparently the thinnings from the Monterey pine plantations are not suitable for mining or fencing purposes, as the poles consist mostly of sap-wood. To make them suitable they will have to be treated by one of the antiseptic processes. The Department realise that of all the preservative methods of treatment, creosote has proved the most efficient in all countries, but as the enhanced price in Europe and America prohibits its profitable use in New Zealand, it may be advisable that a bonus should be offered for its manufacture in that Dominion.

A very successful experiment was made last year, in South Island, of grazing sheep on the fire-breaks. A handsome profit was made from the lambs and wool, and, in addition, the cost of maintenance of the fire-breaks was reduced. It is thought that a limited number of sheep might be grazed advantageously in some of the plantations, and the experiment will be extended to the North Island plantations.

The weather was drier than usual during the spring and summer of last year, and at some of the stations the young plants suffered considerably. Shortage of labour was felt owing to so many men having enlisted in the Expeditionary forces. During the coming year it is hoped to employ discharged soldiers in the State nurseries and plantations.

The importance of providing for future supplies of timber is emphasised. Calculating that the present commercial forests yield 15,000 superficial feet of sawn timber per acre for the whole Dominion, and that 360,000,000 superficial feet is the annual consumption, it would appear that the timber reserves are being depleted to the extent of 24,000 acres per annum. It is, however, anticipated that owing to the quicker growth of the trees now being planted, they will yield more than 15,000 feet of sawn timber to the acre. But before the new plantations are old enough to give returns, the present timber resources will be exhausted. A period of many years must therefore intervene, during which the Dominion will be dependent on foreign supplies at high prices. Timber to the value of £400,000 was imported in 1915, all of which might have been grown at home just as well as in the countries from which it was imported.

It is anticipated that an area of 700,000 acres of commercial forest will be required to meet the demand for timber about

thirty years hence, and as most of the areas reserved for planting in the North and South Islands are filled up, the question of further reservations demands serious consideration. Crown lands are still available, and it is highly advisable that an ample area should be reserved so that when the time comes for its afforestation it may be available without the payment of compensation.

9. Correspondence with the Development Commission, May–June 1916.

The following letters have been exchanged between Sir S. Eardley Wilmot and the Secretary of the Royal Scottish Arboricultural Society:—

THE WARREN, BRAMLEY,
SURREY, 31*st May* 1916.

1. DEAR GALLOWAY,

In your letter of 14th April to the Development Commission you have made certain suggestions as endeavouring to have former proposals brought more into line with what are known to be the views of Scotch landowners.

In the consideration of any large scheme of afforestation in the North, I do not think we can separate afforested and waste land. We require to bring the former into full bearing as soon as possible, and to extend the area of afforested land. In many cases it would be, when leasing waste land, inconvenient and even hazardous to exclude adjacent or intersecting areas of woodland.

So far as discussions have gone, suggestions have been made that land should be leased on payment of the annual rent with a percentage of the profits as afforestation value on renewal of the lease if that only extended over one rotation. In the case of afforested land, the standing crop or its value would be the property of the owner. In both cases, if the owner desired to invest capital in the scheme he would receive a proportionate share of the proceeds.

It would be the desire of the lessee to utilise to the full the existing staff of woodmen and foresters; it might indeed be possible for the owners to take a contract to carry out the work

prescribed in an official working-plan, although full control of the leased area would remain with the State.

The question of sporting rights now comes for consideration. These the State must take over with the view of reletting, preferably to the landowner under certain safeguards to the woodlands. Such might be, for instance, the destruction of rabbits outside netted warrens and the protection of newly planted areas from harmful trespass.

Following on the above, another point arises. Later on steps might have possibly to be taken to prevent the migration of game, of insect pests, and of fungi, into the leased area by means of scheduled areas in its vicinity. Within such scheduled areas the prohibition of keeping rabbits, etc., and insistence on preventive measures against insects and fungi, would be enforced by law, as in the case in the war against agricultural pests at present.

If you could report on the attitude of Scotch landowners on the various proposals and suggestions made in this letter, you would be affording much assistance in the preparation of a forestry scheme suitable for the country.—Yours truly,

S. Eardley Wilmot.

R. Galloway, Esq., *Secretary*,
Royal Scottish Arboricultural Society.

19 Castle Street,
Edinburgh, *5th June* 1916.

2. Dear Sir,

I have received your letter of the 31st ulto., in which you invite me to report on the attitude of the Scottish landowners to the various proposals contained therein.

It seems to me that to adopt that procedure at this stage would involve the loss of valuable time, and I would suggest that the Development Commissioners should first of all deal with each of the five numbered points of my official letter of 14th April. If, when they have done this, they desire to add any other points to their answer, I am sure my Council would give such additional points their careful consideration, but the feeling, so far as I am able to ascertain it, is that it would be desirable to settle, in the first place, the broad principles on which the Commissioners' help in financing schemes of afforestation on leased land can be obtained. I hope, therefore, that you will

advise the Commissioners to adopt the course I have indicated so as to avoid delay as far as possible.

Perhaps I should say that the "bonus or percentage" mentioned in paragraph 2 of my previous letter, refers to the first rotation and not to subsequent rotations only, as your letter would appear to indicate.—I am, dear sir, yours faithfully,

R. Galloway.

Sir S. Eardley Wilmot.

The Warren, Bramley,
Surrey, *7th June* 1916.

3. Dear Galloway,

Thanks for your letter of 5th June. It was precisely with the object of saving valuable time that my letter of 31st May was addressed to you. The meeting of 8th April was, as you state, informal, and the Commissioners prefer to regard the resulting correspondence in the same light, or at most as semi-official, for the reason that though they are grateful for the valuable information and advice which the R.S.A.S. and other private societies may present to them, the actual settlement of "the broad principles on which the Commissioners' help in financing schemes of afforestation on leased land may be obtained" must rest between the Commissioners and the Government Departments concerned.

Assuming this basis of correspondence, I turn to the other items in your letter of 14th April, on which you appear to desire more information.

Your No. 1 deals with the purchase of land, which is not referred to in my letter of 31st May, for the reason that land purchase is not contemplated at this time, and is therefore outside the scope of this correspondence.

Your No. 2 deals with land, rental, and bonus, and I had hoped to have made it clear that both appear to me to be acceptable as a basis of schemes to be formulated. In reference to the final paragraph of your letter of 5th June, I must point out that the bonus claimed for "afforestation value" could not be claimed if the owner resumed the land after the close of the first rotation, because he would be receiving "afforestation value" in the improvement of the resumed land. The bonus would fall due only at the commencement of each succeeding rotation.

Your No. 3 has been dealt with in my letter of 31st May.

Your No. 4 is self-evident, and therefore was not alluded to.

Your No. 5 is also self-evident as regards taking over the standing crop. If the landowner resumes the land and will not purchase the standing crop, he is precluded from interference with it. In my experience divided ownership of soil and forest is not to the advantage of the landowner. Further, the terms of the renewal of the lease would be necessary for consideration towards its close. But the owner could not claim to raise the rental as well as to receive "afforestation value." He might find it more to his taste to take increased "afforestation value" in terms of percentage of increased profits.

I hope you will now be able to give the information asked for in my letter of 31rst May.—Yours sincerely,

S. Eardley Wilmot.

The Warren, Bramley,
Surrey, 19*th June* 1916.

4. Dear Galloway,

In reference to correspondence ending with my letter of 7th June, I learn that during the course of the next few weeks the Development Commissioners will forward their proposals for afforestation and land reclamation to the Reconstruction Committee.

Any information which you may feel inclined to impart in regard to the subject of that correspondence would seem, therefore, to be of special value at this time.—Yours very truly,

S. Eardley Wilmot.

19 Castle Street,
Edinburgh, 20*th June* 1916.

5. Dear Sir,

I have received your letter of yesterday's date. I hope to reply further to your last letter in the beginning of next week, but meantime I have been unable to take up the few points which are still obscure.—Yours very truly,

R. Galloway.

Sir S. Eardley Wilmot.

19 Castle Street,
Edinburgh, 21*st June* 1916.

6. Dear Sir,

Since writing you yesterday, I have been able to look into the points which I think are not yet clear. These are points 2 and 5 of my official letter.

2. *Rent and Bonus.*—These are agreed to in principle, but there are two details still to be settled—(1) the amount of the bonus or the method by which it is to be ascertained, and (2) what it represents and when it is to be paid.

You were to consider and report upon the first of these points. With regard to the second, you appear to indicate that it represents only "afforestation value" and that it should not be paid till a renewal of the lease has been agreed to. I think it also represents recompense for the landlord's "helpful interest" in the venture.

I understand the landlord's argument for "afforestation value" is something like the following:—The present rent of the land is adopted as suitable to the existing conditions; but these conditions are to be altered for the better by afforestation under proper management, and a share of this gradual betterment should go to the landowner. This new crop is to provide better financial results than the old crop, and the landowner's share of these increased results should come to him periodically as soon as they can be ascertained. He, therefore, thinks that he is entitled to a bonus for the first rotation, and that it should come to him periodically and not in a lump sum at the beginning of a new rotation. Put shortly, this means that the present rent is too low for land to be devoted to afforestation purposes, and that the landowner is entitled to a higher rent when embarking on this new and more profitable industry; but he is prepared to take the increase of rent by way of a bonus, which should increase with each rotation as the value of the land increases.

If the lease is renewed then I agree that an increased bonus would be fairer than an increased rent.

If the lease is not renewed there might be alternatives:—(1) That the landowner should take over the crop at valuation, or (2) that he should take back the land as it is cleared by the lessee and receive rent and bonus for the remainder till received back.—Yours sincerely, R. Galloway.

Sir S. Eardley Wilmot.

THE WARREN, BRAMLEY,
SURREY, 22*nd June* 1916.

7. DEAR GALLOWAY,

Many thanks for your two letters of 20th and 21st June. The latter will prove of great value for it is the principle we seek to lay down. The details will probably vary in each individual transaction.

I am afraid I am giving you a lot of trouble, but would you now favour me with some remarks on the question of game and insects and forestry on the lines of the suggestions I made in opening this correspondence?—Yours very truly,

S. EARDLEY WILMOT.

19 CASTLE STREET,
EDINBURGH, 27*th June* 1916.

8. DEAR SIR,

I duly received your letter of the 22nd, and have since been trying to ascertain the views of owners regarding game and insects.

As the Board of Agriculture apparently has already power to deal with agricultural and horticultural insects, perhaps they have sufficient power to do what is necessary with regard to woodland insects and pests. If they have not, I think there would be little difficulty raised if additional powers were asked.

The game question is rather more difficult, and it is just possible that it will have to be left for discussion and settlement in each individual case. There is a general feeling, however, that something will have to be done very soon to prevent the multiplication of rabbits, and I think it probable that such an arrangement as you propose might not be seriously opposed. I suppose, however, legislation would be necessary, and in that event, I believe, the opposition would not be strong enough to prevent a reasonable measure from going through.

I am afraid I cannot say anything more definite on these two points at present.—I am, yours very truly,

R. GALLOWAY.

SIR S. EARDLEY WILMOT.

10. The Development Fund and Forestry.

Note of sums recommended.

THREE YEARS TO 31ST MARCH 1913

(as detailed in the Article of 2nd February 1914, printed on pp. 138-153 of Vol. xxviii. of the *Transactions*).

. Grants . .	£26,635		
Loans . .	£25,000		
		Total	£51,635

YEAR TO 31ST MARCH 1914.

	Grant	Loan	
Board of Agriculture and Fisheries.			
Forestry Research and Advisory Work during 1913-14. . . .	£6,500		
Forestry Research and Advisory Work during 1914-15. . . .	8,100		
Distilling Plant for the Utilisation of Wood Waste, 1914-15 . .	250		
	£14,850		
Department of Agriculture and Technical Instruction for Ireland.			
Work of Afforestation on the Ballyhoura Area		£31,430	
Expenses of Forestry Staff, 1911-13 .	1,250		
Salaries and Expenses of Central Forestry Staff during 1914-15 . . .	1,649		
Edinburgh and District Water Trust.			
Afforestation Work at the Talla Water-Catchment Area . . .		150	
Kildare County Council.			
Maintenance, etc., of Woodlands in the County (to cover a period of 5 years)	1,385		
Liverpool City Council.			
Afforestation of the Council's Water-Catchment Area at Lake Vyrnwy .		25,000	
Commissioner of Woods.			
Demonstration Area in Forest of Dean .	15,400		
	£34,534	£56,580	
		Total	£91,114

Note.—The total sum recommended up to this time was £142,749, and it was stated in the report that a further £200,000 would be necessary up to 1916 for a demonstration area for Scotland, one or more experimental areas in England and Wales, afforestation of land purchased in Ireland, and loans to Local Authorities for planting water-catchment areas.

Carry Forward £91,114

	Brought Forward		£91,114
YEAR TO 31ST MARCH 1915.			
Aberdeen University.	Grant	Loan	
Forestry Instruction (Adaptation and Equipment of Buildings) . .	£750		
Board of Agriculture and Fisheries.			
Scholarships in Forestry for Students at Woodmen's Schools . . .	150		
Board of Agriculture for Scotland.			
Advisory Forest Officers at the three Scotch Agricultural Colleges, 1914-15	1,500		
Advisory Forest Officers at the three Scotch Agricultural Colleges, 1915-16	1,500		
Commissioners of Woods, etc.			
Demonstration Area in the Forest of Dean (Additional grant) . . .	800		
Temporary Assistant to Deputy Surveyor of Dean Forest	100		
Department of Agriculture and Technical Instruction for Ireland.			
Purchase of Land for Purposes of Afforestation		£21,750[1]	
Afforestation at Ballyhoura, 1915-16, (£1,500).			
Afforestation at Slievebloom . .		26,605	
,, at Glendalough and Aughrim		22,876	
Expenses of Central Forestry Staff, 1915-16	1,442		
English Forestry Association.			
Work in obtaining Information and organising Supplies of Timber for Collieries and other Industries .	500		
Oxford School of Forestry.			
Forestry Research Laboratory . .	60		
	£6,802	£71,231	
		Total	£78,033
YEAR TO 31ST MARCH 1916.			
Board of Agriculture and Fisheries.	Grant	Loan	
Continuation of Scheme for Advisory Work, Research and Minor Forestry Experiments, 1915-16 . . .	£7,200		
Carry Forward	£7,200	...	£78,033

[1] In view of the financial stringency this recommendation has not been sanctioned by the Treasury.

Brought Forward	£7,200	...	£78,033
Continuation of Scheme for Advisory Work, Research and Minor Forestry Experiments, 1916-17 . . .	5,750		
Commissioners of Woods, etc.			
Maintenance of the Forest of Dean Demonstration Area, 1915-16 . .	850		
Provision of Nursery Stock for Emergency Afforestation Operations . .	1,100		
Board of Agriculture for Scotland.			
Salaries and Expenses of Advisory Forest Officers at the three Scottish Agricultural Colleges, 1916-17 . .	1,000		
Advance to meet any Expenditure which may be found necessary during 1916-17, in connection with Preliminary Arrangements for Leasing or other Proposals for the Afforestation of Privately-owned Land in Scotland . . .	1,000		
Department of Agriculture and Technical Instruction for Ireland.			
Working Expenses of the Glendalough-Aughrim, Slievebloom, and Ballyhoura Afforestation Areas, 1916-17 . .	2,000		
Expenses of Central Forestry Staff, 1916-17	1,286		
District Committee of the Middle Ward of the County of Lanark.			
Afforestation of the Water-Catchment Area at Camps in the Parish of Crawford. Loans of £600 have been sanctioned by the Treasury, the question of further assistance to be considered after the end of the War . .		£600	
	£20,186	£600	
		Total	£20,786
Totals to 31st March 1916 :—			
Grants . .	£88,157		
Loans . .	£153,411		
			£241,568

Apportioned to Countries, thus :—

	Grants	Loans	Total
England . .	£59,345	£25,000	£84,345
Scotland . .	16,750	750	17,500
Ireland . .	12,062	127,661	139,723
	£88,157	£153,411	£241,568

ABSTRACT OF EXPENDITURE IN EACH COUNTRY.

	England	Scotland	Ireland
Afforestation			
(Liverpool Water Area)	£25,000		£84,296
(Talla £150, Mid-Lanark £600)		£750	
Demonstration Area			
(Forest of Dean)	17,150		
Advisory Research, Administration, etc.	62,195	16,750	8,677
Land Purchase . . .			46,750[1]
	£84,345	£17,500	£139,723

11. Root Rot of Coniferous Seedlings.

The study of the diseases incidental to coniferous seedlings, while of great interest to the plant pathologist, may be of the greatest practical value to the nurseryman and forester, especially when not only the cause is ascertained, but when an appropriate remedy, and better still a means of prevention, can be suggested.

In a paper which appeared in *Phytopathology*, vol. v., No. 4, August 1915, Mr Arthur H. Graves makes a valuable contribution to our knowledge of coniferous seedling disease. The author first points out the injurious influence of faulty soil æration on the health and growth of old trees. He then goes on to say: "The disease in question appeared in the nursery of the Yale Forest School during the spring and early summer of 1914, and was particularly destructive. Besides the loss of about twenty per cent. of a bed of one-year-old red pines, *Pinus resinosa*, Ait., and five per cent. of a bed of one-year-old white pines, *Pinus strobus*, L., several thousand two-year-old red pines succumbed, as well as a few seedlings of one-year-old hemlock, *Tsuga canadensis* (L.), Carr.

"The disease first became noticeable through a dark red or reddish-brown coloration of the tips of the leaves. In the initial stages the contrast of this dark red colour with the remaining deep green of the leaves was very striking. By slow degrees, extending over an interval of several weeks, the red colour extended throughout the entire leaf to its base. Subsequently the reddish hues changed, usually to browns or

[1] £21,750 of this not sanctioned by the Treasury owing to the financial stringency.

yellow-browns, and the final colour was, in most cases, some shade of yellow, although often intermixed with reddish tints.

"A long period—at least a month—was required for this sequence of colour changes; and, at the end of this time, in case the disease had proved fatal, the whole plant was stiff, dry and entirely dead."

It was observed that the disease occurred in more or less irregular patches scattered throughout the beds, and that the diseased patches were almost always situated in slightly sunken portions of the beds, as well as along their margin where drainage was poorest. A careful investigation failed to reveal the presence of any pathogenic fungus.

For the following reasons the author concludes that the disease is due primarily to unfavourable soil conditions:—

"1. Repeated attempts to isolate from the roots a pathogenic fungus or fungi as causal organisms in the disease were always attended with negative results. These experiments consisted of (1) incubation in moist chambers of roots which had recently died, (2) insertion of the inner portions of diseased roots, removed with a sterile scalpel, in nutrient agar, and (3) placing such roots, whole, in nutrient agar. In every case no forms appeared except saprophytic fungi, and bacteria which were presumably saprophytic. One fungus, which was kindly identified by Mrs Flora W. Patterson, *Cylindrocladium scoparium*, Morgan,[1] was of such general occurrence that it was viewed with suspicion, but inoculations of healthy seedlings in sterilized soil with this form gave only negative results.

"2. The soil of the seed-beds was stiff and clayey, and although a considerable amount of leaf-mould had been added to it, there was still a very small proportion of humus. As a consequence its porosity was slight, and in rainy periods the water would stand for some time in the hollows and poorly drained parts. Such conditions would naturally prevent a free access of oxygen to the roots, and would therefore readily promote root rot.

"3. The disease caused most havoc during the months of March and April, when the soil was still soggy from the winter freeze and rains, and when the roots, on the other hand, stood in the greatest need of oxygen for the commencement of metabolic activities incident to the season's growth.

[1] Morgan, A. P., "Two new genera of Hyphomycetes," *Bot. Gaz.*, 17, 190-192, 1892.

"4. In June and July, when the soil conditions were much improved over those of early spring, many cases of recovery from the disease were observed, as shown by the fact that new roots had developed in the region of the root collar. At this time seedlings which were recovering and forming new roots could be detected very often by a glance at the tops. If these were starting a belated growth, inspection of the root-system in every case would reveal, usually, one or sometimes more new roots, conspicuous by reason of their white colour, their thickness, and origin high up, near the base of the stem. Such recovery, which was of fairly common occurrence, is more in line with a physiological trouble, than a disease caused by a parasitic fungus.

"5. The course of the disease was slow, requiring at least a month for its completion. In many cases, even after three months of growth, *i.e.* about August, the tops still appeared healthy, although the year's growth had not developed, and examination of the roots showed them to be apparently dead. Here a considerably longer period would have been necessary before the plants entirely succumbed. A very gradual death of this sort would not be expected if the trouble were due to the attack of a parasitic fungus.

"6. In soil of a similar character, in another part of the nursery, which had been thoroughly limed, and contained a generous amount of humus, such a disease had never been known to occur. This soil was loose and porous, never retaining water on its surface for any length of time.

"The conclusion is, therefore, that the disease was due to lack of oxygen trouble in a soil which was saturated with water, *i.e.* that the roots were suffocated.

"As already intimated, the remedy would consist in a thorough liming of the soil. Probably this in itself would be sufficient, but the addition of more humus would also improve the physical character of the soil as well as benefit the plant growth directly."

12. Scrub and Old Oak Coppice Woods.

By J. M. Murray, B.Sc.

In many parts of the country there are to be seen large areas covered by scrubby woods of variable composition, and old overgrown oak coppice. The scrub is usually either the result of misguided planting, or of the natural seeding of neglected grazing land. The crop is generally a scattered one consisting mainly of gnarled, branchy and often bush-like birch, alder, mountain ash or oak. Sometimes there is an underwood of hazel and thorn. In addition to growing trees some of these areas are grazed over, and if let, the rent is often only a very low one. Neither from forestry nor agriculture is the proprietor obtaining a full return for this type of land.

The coppice woods are relics of by-gone days when oak bark was a valuable product. These woods were then worked systematically and at a profit. With the introduction of more rapid tanning materials the price of oak bark fell, but the death-knell of coppice woods was sounded by the great increase in wage-bills. As long ago as 1868 we find foresters complaining of a great decrease in profits, and advocating the conversion from coppice to conifer high-forest.[1] In few parts of Scotland has any real conversion been done. Most owners preferred to neglect the "hags," although a few tried to make a conversion to oak high-forest by pruning and training selected stems. They hoped these would ultimately become trees of some size. This hope has usually been a vain one, although the size and quality of the stems depend on the age of the parent stools, and on the nature of the soil and climate. The younger the stools, the richer the soil, and the warmer the climate, the larger and more vigorous have the stems become. In general, however, coppice woods were formed on soils that were not the best for oak, and in consequence the stems are low, with flat crowns. Against this there are instances of coppice shoots ultimately becoming trees of from 30 to 50 cubic feet in 150 years. This may happen on heavy soils; but taking into consideration all the types it may be said that, as a general rule, coppice stems do not seem to be capable of

[1] In the *Transactions* of this Society, Vol. iv. p. 147, W. M'Corquodale, Scone, writes "On the Conversion of Coppice Land into a more Remunerative Crop."

attaining an average size much over 12 to 14 cubic feet in from sixty to seventy years. After that the volume increment is low. Apart from consideration for the beauty which coppice and scrub woods possess, their total removal has been delayed mainly by financial considerations. No profitable market could be got for the timber, and the price of bark would hardly do more than repay the labour necessary to harvest it. The present, however, seems to be an opportune time for the removal of large areas of this, till recently, comparatively worthless crop. The demands for timber are now great; the mines require large quantities for props, and necessity has compelled mine-owners to accept many kinds of timber at which they formerly looked askance. The demand for high explosives is likewise pressing, and the furthering of their output is a national duty.

Both the mine and wood-distillery owners can be given great help by the utilisation of coppice and scrub woods. On the other hand, the property owner may think of his own interests. Prices for all kinds of timber are high, and this is especially so for pit timbers. In addition almost anything will be accepted for this purpose at present. It is not likely, however, that the rougher classes of props will retain their present high prices for long after the war. The price of conifer props will be likely to fall more slowly, and in any case they will compete more favourably with the imported material. Might it not be wise to spare our coniferous woods to some extent? On these points alone the owners of scrub and coppice woods have evidently great opportunities for utilising these possessions or of considering their future.

The areas they have endeavoured to train as high-forest from coppice deserve special attention. Their increment and general condition should be carefully considered, and then if it is decided to leave them, underplanting should be done as soon as possible. The species selected for underplanting ought to be a shade-bearer that will improve the soil and the overwood. It should also be one that will produce a good monetary return. Of all trees, beech is most likely to satisfy the silvicultural demands, but to advise its use might not always be sound financially. Others, such as silver firs, *Thuja*, *Tsuga* or Douglas fir might be used.

The scrub and neglected coppice woods are entitled to but

little consideration on the score of their future forest value. They and the rejected trained coppice woods should be taken in hand immediately.

Before commencing cutting it would be well to draw up some definite scheme of operations showing how the areas will be restocked. Then, on those parts where hardy light-demanders such as larch and Scots pine are to be planted, clear-cutting may be practised. In other parts where species at all likely to be affected by frost are to be planted, an endeavour should be made to leave shelter trees. These may be few or many according to their height and size of crown. In no case should large trees be left, since they are troublesome to remove and always leave blanks in the young crop.

As an example of the number required, I might mention a case in which about forty to fifty trees, averaging 22 feet in height, were found sufficient. Such a shelter is a boon to young plants, and their growth is very much improved. In particular is this the case with Sitka and Norway spruces, Douglas fir, *Tsuga*, *Thuja*, and the various silver firs.

The following is a striking example of the value of light overhead shelter of this kind. On a low-lying area on the shores of the Moray Firth an attempt was made to grow Sitka spruce. Owing to frost the result was utter failure, except on a small part where natural birch grew. The forester thinned out the birch and planted the spruces, with such good results that not over two per cent. died. I would also refer in this connection to Mr Macdonald's article in Vol. xix., page 287, of the *Transactions*. On Murthly estates coppice woods have been used with great success as shelters. The shelter trees ought to be left till all danger of frost is past, and then removed gradually so that any felling does not expose the plants unnecessarily.

In utilising the scrub and coppice woods all possible economy should be practised. A good selection should be made of the timber, classifying it into pit-wood, bends for small boat-building, chemical wood or firewood, and timber for turning mills, etc. In the case of birch even the twigs are useful and can readily be sold to steel works. It is by taking timely advantage of all markets that most will be made out of timber and other forest products.

13. Forestry Developments at Craibstone.[1]

By P. Leslie, M.A., B.Sc.

The estate of Craibstone, which was purchased by the North of Scotland College of Agriculture in 1914, is situated about five miles from the city of Aberdeen, and two miles from the nearest suburban railway station. Among the varied purposes which the estate is intended to serve is that of a forest garden, or small demonstration area, for the Forestry Department of the College and the University of Aberdeen.

There are about 260 acres of woodland on the estate (including 180 acres of unstocked ground). Part of this is in scattered patches about the mansion-house, but the bulk is in the west part of the estate on the lower slopes of Brimmond Hill. The timber, mainly Scots pine and spruce, is of different ages, and a proportion of it was recently sold to the Government Home-Grown Timber Committee. Owing partly to the increase in the value of timber since the war, the amount received for the wood sold to the Committee considerably exceeds the price paid for the whole of the timber on the estate when it was purchased by the College. Nor will the removal of this timber in any way lessen the educational value of the area, as it is only the surplus timber, which would have been of little value for educational purposes, that has been sold, and the richness and variety of the woodlands will not be in any way impaired. The woods which have been left include compact areas of mature and middle-aged woods in addition to the policy woods, and will be of the greatest value for forestry instruction and experimental purposes.

The avenue leading up to the mansion-house and the policy grounds are stocked with a variety of native and exotic trees, both hardwood and conifers, which add greatly to the interest of the place. There are already here all the elements of a fine arboretum, and under the College of Agriculture this feature will be developed. All the commoner species of trees are well represented, and there are some well-grown specimens of beech, lime, elm, ash, oak, chestnut, poplar, false plane, Norway maple, larch, Scots pine, silver fir, Douglas fir, spruce and Sitka spruce, as well as species more rarely seen in the North of

[1] An interesting article on Craibstone appeared in the *Aberdeen Free Press*, on 7th August 1914, on which some of these notes are based.

Scotland, such as the field maple, Lawson's cypress, *Thuja gigantea*, *Abies nobilis*, *Abies concolor*. Some of the silver firs, Scots pine and larch have attained a great size, girthing more than 10 feet in circumference at breast-height. The finest specimens of these trees will be retained, and it is intended to plant in addition a large variety of trees and shrubs, many of which may be of no commercial value, but may fitly have a place in the arboretum attached to a forestry educational centre.

In the field to the west of the mansion-house a nursery extending to an acre and a half has been laid out, and is surrounded by rabbit-proof netting. A nursery will be a necessary adjunct of the Forestry Department of the College. When conditions become normal again after the war, and forestry students resume work at the College, the intention is to demonstrate all the branches of arboriculture in the Craibstone woods, so far as is possible on a small area. The method of sowing and raising seedlings will be shown, and the seedlings grown on the estate will be used to replant the areas that are cleared.

A far more extensive enterprise than this is, however, in view, and what is to be now seen at Craibstone is not a college nursery or estate nursery, but a national forest nursery, the first of its kind in Scotland. The Board of Agriculture for Scotland have rightly seen that one of the great subjects demanding attention after the war will be the afforestation of the country, with a view to strengthening our timber resources and repairing the tremendous cutting that is going on during these times of emergency. There will be a great demand for trees, and as it takes three to four years, in most cases, to raise trees ready for planting, no time should be lost in getting a stock of plants ready. The Board have recently been encouraging professional nurserymen to increase their stocks of plants, and have in addition given a grant to the College for the formation of this nursery at Craibstone, where some two or three million trees are now being raised, sufficient to plant, a few years hence, many hundreds of acres.

The nursery is laid out in seed-beds some 35 yards long and 4 feet wide. A fine tilth was formed, and the seed was sown broadcast in May and the beginning of June. The wet spring was trying, but the seed has done well, and the young trees are

all that could be desired. The species sown are chiefly Scots pine, spruce, and larch, along with a few beds of Douglas fir and Japanese larch. The weeding was done by girl students from the Training Centre and the University during their summer vacation. There were ten of these girls, and they lived in the bothy at the home farm, doing their own cooking and providing for themselves. They worked seven hours a day, from 7.30 to 3.30, and were employed from the beginning of July to September, when the need for weeding ceased. Their work was entirely satisfactory, and they were keenly interested in the nursery. In addition to the seedlings, there are in the nursery several thousand plants of Sitka spruce, Douglas fir, *Thuja gigantea*, *Tsuga Albertiana*, which were purchased from outside nurseries and lined-out in the spring-time as 2-year old seedlings. Next year it is intended to extend greatly the present area of seed-beds, and two or three years hence, the whole of the seedlings will be lined-out in a large field adjoining the present nursery.

No planting has as yet been done on the estate, but a grant has been sanctioned by the Development Commissioners for a forest garden of 30 acres. A strip on the north side of the main woodland area, of about 30 acres in extent, has been reserved for this purpose and will be laid out in sections, 1 acre or half an acre in extent, for the carrying out of experiments on such subjects as heredity, manuring, the ascertaining of the behaviour under silvicultural conditions of species whose commercial value is not yet clearly established, and others which can be appropriately carried out on plots of this size. In the west wood area it is also proposed to retain compact areas of mature and middle-aged woods (which will be heavily thinned and under-planted), in order that students may be afforded facilities for the measuring of timber and for demonstrating on a small scale felling and thinning operations. The remainder of the woodland area will be planted up with small pure woods or plots, 5 or 6 acres in extent, intended to demonstrate the growth and development of a number of species into timber under conditions comparable to those which would exist in an ordinary forest.

The Craibstone woods are, of course, intended primarily for the instruction of students attending the forestry classes of the College, but in the near future they are also to be used for the training of a number of returned soldiers desiring to take up

forestry as their future occupation. During the next few years excellent facilities will be afforded these men on the estate for acquiring a practical knowledge of forestry. Part of their period of training will be spent in the felling and conversion of the timber purchased by the Home-Grown Timber Committee, and in the extensive nurseries now being formed, while at other times they will be employed in planting or in the preliminary operations of fencing, roadmaking or draining. Experienced foremen will be in charge of the different operations, and the men working under their direction will be grouped in small squads so that as much attention as possible may be devoted to the training of each individual. Alongside with this practical training the men will also have facilities, by means of lectures and demonstrations, for acquiring a knowledge of the principles underlying the practice of forestry, sufficiently extensive to make them useful woodmen. In order that they may derive the full benefit of this teaching, every effort will be made by the governors and staff of the College to ensure that the courses of instruction, while being made as comprehensive as possible, will be easily followed and of a kind specially adapted to their ability and requirements.

14. Particulars of the Farm of Borgie. Presented to the State by the Duke of Sutherland.[1]

Description of the Farm.—The farm of Borgie is situated partly in the parish of Tongue and partly in the parish of Farr in the northern part of Sutherland. The area of the farm is approximately 12,200 acres. It is a grazing farm and carries from 2000 to 2200 cheviot sheep of good quality, also some cattle and horses. It has been farmed for many years by the Duke of Sutherland, who employs three shepherds and two ploughmen, and these, with the gamekeeper and a small tenant, are the only householders on the place. The hill-grazing is fairly typical of Sutherland generally. The land under cultivation yields a good crop of oats, potatoes and turnips, and areas of land at different points are capable of reclamation. In the

[1] Excerpted from a Memorandum presented to both Houses of Parliament, 10th November 1916.

immediate vicinity there are 87 small holdings, and the wider area from Tongue to the river Naver contains about 130 small holdings. The shooting over the farm consists chiefly of grouse, and it is reported that about 400 brace can be killed upon it in an average season. The sporting rights, including the fishing, have been let hitherto along with other adjoining lands, and it is not possible, in consequence, to state the actual rent. In normal times the shooting and fishing rights conveyed to the State might be expected to yield an annual revenue of from £300 to £400. The Duke of Sutherland reserves the fishing in the river Borgie and in a few lochs on or near the boundaries of the farm, and likewise retains an option over 2 acres of land for the erection of a fishing lodge and offices, which may be required to take the place of the lodge and offices made over to the State. With the exception of this reservation and option the deed of gift will convey the lands absolutely to the State.

The buildings on the farm which form part of the gift consist of:—(1) Borgie lodge (a two-storied building) and offices; (2) the farm steading; (3) ploughman's house; (4) shepherd's house, etc., at Borgie; (5) shepherd's house, etc., at Dalness; (6) a dwelling let to a tenant.

The rent of the farm for assessment purposes has been entered on the Valuation Roll at .	£167	16	6
The estimated rent of the lodge and shootings and fishings, which, as explained above, were let with other subjects, was in 1914-15	370	0	0
The rent of the dwelling let to a tenant (No. 6 above) is	5	0	0
There is a feu-duty of	1	0	0
and the feuar rents a park of land at .	2	10	0
	£546	6	6

In 1915-16 the shootings were unlet.

The Duke of Sutherland's intention was to remove the sheep and the other stock and crop and implements and the furniture in the lodge, but at the request of the Secretary for Scotland it was agreed that these subjects should be taken over from the Duke at prices to be mutually agreed upon. No acclimatisation value has to be paid for the sheep, and no compensation will have to be paid for the removal of a farming tenant.

COUNTY AND PARISH RATES PER £ FOR 1915–16.

	Parish of Farr		Parish of Tongue	
	Owner	Occupier	Owner	Occupier
	d.	d.	d.	d.
County	21·967	18·500	21·967	18·500
	s. d.	s. d.	s. d.	s. d.
Poor	1 4	1 3	1 11	1 8
School	0 10	0 10	1 4½	1 5½
Registration	...	...	...	...
Special Parish ...	0 1¼	0 1¼	0 1	0 1

Land tax on whole, 15s.; ministers' stipends on whole, £7, 2s. 6d.; heritors' assessment, say (on average of five years), £2.

Small Holdings and Afforestation.—The land has been inspected by the land and forestry staff of the Board of Agriculture for Scotland, and it is reported to be suitable for the creation of small holdings in conjunction with afforestation.

Scheme of Settlement.—The farm is to be conveyed to the Board of Agriculture for Scotland, and it will be held by the Board for the State in terms of the deed of gift by the Duke of Sutherland. It is to be used primarily for the settlement of sailors and soldiers who have enlisted voluntarily and have a good record of service. Not less than half of the holdings will be available for men who have served in the navy. The selection of the tenants will be in the hands of the Secretary for Scotland. The holdings will be equipped with suitable dwellings and steadings. Work will be available for the tenants in the plantations and woods.

Afforestation.—The area which it is proposed to set apart for afforestation is sheltered from the prevailing and most dangerous northerly winds, and although it is surrounded on the west and south by the high mountains of Ben Hope and Ben Loyal, only a very small area of the farm exceeds the 1200 feet contour line. The plantable land begins at an elevation of about 200 feet above sea-level and the greater part of it stands under 900 feet.

The general physiography of the area is favourable to afforestation. There are no steep, abrupt faces to be planted; on the contrary, the planting ground rises in gentle uniform slopes from the main and side valleys. The valleys are broad

and uniform. There are no narrow necks, nor do the valleys contract towards their upper reaches. The tendency is rather to open out in a fan-like manner. These features will reduce the risk of damage by wind which is apt to be more severe in narrow contracting deep valleys. These physiographical features will also make drainage an easy operation wherever it may be required. The formation of the ground on both sides of the main valley of the Borgie is particularly favourable for road making; and the carting of timber, when the time comes for its removal, will be over practically level main roads with a general tendency down hill. A nursery for seed-beds and plants can be formed near Borgie steading. The buildings already on the ground are considered sufficient for the working-staff required for estate management and afforestation.

Appeal.—In presenting the foregoing particulars to the House of Commons, the Secretary for Scotland (Mr Tennant) made a strong appeal to other landowners to follow the Duke of Sutherland's excellent example. We heartily associate ourselves with that appeal, but we desire to extend it to the many wealthy, generous and patriotic men in the Empire who, although they may not have land in this country to offer, may nevertheless be glad of an opportunity to assist, in a most effective way, the great movement for afforestation and repopulation of our bare hills and glens, by gifts of money for the purchase of land to be used for this most necessary and beneficial purpose. R. G.

15. The Coniferous Forests of Eastern North America.[1]

By Dr Roland M. Harper.

In eastern North America about thirty species of coniferous trees make up at least two-thirds of the existing forest, while the remainder comprises something like 250 hardwood or broad-leaved species. About 70 per cent. of the lumber sawed in the eastern United States at the present time is of conifers or softwoods, and if the statistics for eastern Canada and for fuel, pulp-wood, cross-ties, poles, etc., were included the preponderance of softwood in the area under consideration would be still more evident. Most of the houses in the United States and

[1] Reprinted from the *Popular Science Monthly*.

Canada are built of coniferous wood, most of our paper comes from the same source, and, in all but the most densely populated regions, most of the domestic fuel.[1]

From the relative abundance and number of species it is evident that the average conifer species is represented by a much larger number of trees than the average hardwood. It happens that most of our conifers form pure stands of greater or less extent, in some part of their ranges at least, so that there are about as many types of coniferous forest as there are species of conifers. All but a few of the rarer or less important types will be described below, beginning with the northernmost, which are mainly confined to the glaciated region, and ending with those confined to the coastal plain, and one whose range extends southward into the tropics. The treatment of each type will include geographical distribution, correlations with soil, water, climate, fire,[2] etc., and notes on the economic aspects of the trees themselves and the regions in which they grow.

The Forest Types in Detail.

The Boreal or Spruce Type.—The northernmost type of forest, which covers almost the whole of eastern North America, from the Arctic tundra down to latitude 45°, with many more or less isolated areas farther south, especially in the mountains, is mainly composed of Jack pine (*Pinus Banksiana*), tamarack (*Larix laricina*), two or three species of spruce (*Picea*), balsam fir (*Abies balsamea*), and arbor-vitæ or northern white cedar (*Thuja occidentalis*). In places some one of these may cover considerable areas exclusively (this is especially true of the pine), but usually two or three of them are mixed together.

[1] A map between pages 488 and 489 of the ninth volume of the Tenth Census shows the distribution of coal and wood fuel in the United States three decades ago.

[2] Forest fires have generally been looked upon as regrettable accidents, and much more thought has been given to devising means to prevent them than to studying their geographical distribution and historical frequency. But those that start from natural causes seem to be just as much a part of Nature's programme as rain, snow and wind (which, like fire, may do both good and harm at the same time), and to be subject to more or less definite laws Their frequency, extent and effects vary greatly in different parts of the country and in different types of forests, as will be shown below, and nearly every species of conifer seems to have become accustomed or adjusted to a certain amount of fire, as to other environmental factors.

They have much in common in general appearance, mature trees being as a rule spindle-shaped or narrowly conical in outline, with more or less deflexed branches, and leaves an inch or less in length. The tamarack is deciduous, and the rest evergreen.

Forests of similar aspect, and made up mostly of trees of the same genera, cover large areas in all the cooler parts of the northern hemisphere. Doubtless on account of the abundance of such trees in northern Europe, where most of our Anglo-Saxon traditions orginated, the spindle-shaped tree has become firmly established as the conventional type of conifer. Illustrations of these trees in their native haunts abound in publications dealing with outdoor life in the extreme northern states and Canada, printed since the invention of the half-tone process, about thirty years ago.

In the United States the Jack pine prefers coarse sand, and the other trees above mentioned are found mainly in peat bogs; but farther north they may grow in almost any kind of soil, wet or dry. (In Alaska, even some of the glaciers are said to be partly covered with spruce forests.) The regions where they grow are characterised by cool and moderately humid climates, with an average temperature of 45° F. or less, and an average growing season (*i.e.*, period free from killing frosts) of not more than 150 days. The ground freezes several feet deep in winter, and temperatures of – 30° F. or lower are likely to be experienced by each tree many times during its life.

The average annual precipitation is 20 inches or more, and in most places in the boreal conifer region there is more of it in summer than in winter, which tends to keep the soil moist throughout the year.

A climatic factor which involves both temperature and precipitation is the amount of snowfall; and it appears from statistics of the snowfall of the United States recently published that the type of forest under consideration can be correlated pretty closely with an average annual snowfall of 50 inches and upward. Although it would not be exactly correct from a biological standpoint to say that the narrow conical form of these trees is an adaptation to heavy snows, like the steep roofs of Norway, for example, it would be difficult to imagine any other form of evergreen tree with the same amount of wood and foliage which would be less liable to injury from snow and ice

than the spruces and balsams. The tamarack has an additional safeguard in that it loses its leaves in winter; and at the northern limit of the forests it is said to grow comparatively tall and straight, while the spruces around it are much stunted.

Burned areas, in which all the trees have been killed by fires sweeping through their crowns, are and always have been, from all accounts, common throughout the spruce region (not only in the East, but also in the Rocky Mountains, where forests of different species but similar aspect predominate); and many great fires involving loss of life and much property have become historic,[1] In northern Michigan, and doubtless in many other places where spindle-shaped conifers abound, posters warning against the dangers of allowing fire to spread greet the traveller at every turn;[2] and some of the western railroads print similar advice in their time-tables.

Although at the present time the origin of most of the northern forest fires can be ascribed to human agencies, lightning is known to cause a considerable proportion of them (estimated by Plummer at 15 per cent.), and in prehistoric times it must have been the principal cause.[3] From all the evidence available it would seem that the normal frequency of fire at any one spot in the boreal conifer forests is about once in the average life-time of a spruce tree, which may be between 50 and 75 years. The average extent of a single fire must be several square miles.

In the untold ages that fire has been a factor in the life-history of these forests, there has developed a class of plants known as fireweeds, consisting of a score or more of herbs, shrubs and short-lived deciduous trees, such as birch and aspen, which quickly take possession of burned areas and flourish until the dominant, but more slowly growing conifers have time to re-establish themselves. When the foliage of the conifers is

[1] See Pinchot's "Primer of Forestry" (U.S. Forestry Bulletin 24), part 1, pp. 79-83, 1897; also U.S. Forestry Bulletin 117, by F. G. Plummer, 1912, especially map on page 22.

[2] Several such posters are reproduced in colours in *American Forestry* for November 1913.

[3] See papers by Dr Robert Bell in *Forest Leaves* for October 1889, and the *Scottish Geographical Magazine* for June 1897, and Bulletins 111 and 117 of the U.S. Forest Service, by F. G. Plummer, 1912. The second of Dr Bell's papers, which is on the forests of Canada, contains much valuable information on other subjects than fire.

consumed by fire, the potash and other mineral nutrients stored up in several years' growth of evergreen leaves is returned to the soil in readily available form, and this must be a significant factor in the rapid growth of the fireweeds. Quite a lengthy chapter could be written about this phenomenon, which has almost no counterpart in the coniferous forests farther south, where fires are nearly always ground-fires, and do not kill the trees outright.

The economic aspects of these northern forests are numerous and varied. The soil and climate are not very favourable for agriculture, so that the farmer, the greatest enemy of forests in this country, has done little damage, and the timber is in no immediate danger of exhaustion. The trees are used to a considerable extent for lumber, and almost as much for pulp-wood ; nearly all the large paper mills in North America being located not far from such forests. Logging is nearly all carried on in winter, when the snow facilitates hauling the logs to the nearest river or railroad. The Christmas trees used in northern cities are nearly all brought from the same region. The same forests furnish our spruce gum and Canada balsam, and among them are found the most important peat deposits in North America.[1]

The boreal conifer region is a favourite resort for hunters, trappers, fishermen, berry-pickers, campers, canoeists, hay-fever sufferers, etc., most of whom migrate northward in summer from the densely populated regions a little farther south. At certain times and places mosquitoes and black-flies make life in the north woods somewhat burdensome, but the mosquitoes are at least not of the malarial variety, and poisonous snakes and some other pests are conspicuous by their absence.

The White Pine (*Pinus Strobus*) ranges from Newfoundland and Manitoba to the mountains of Georgia, and associates with many other trees, mostly hardwoods, in various parts of its range ; pure stands of it being the exception rather than the rule. It grows in almost any kind of soil except the richest and poorest, wettest and driest, but seems to prefer that containing a moderate amount of humus. From its distribution we may infer that it is confined to climates where the average temperature

[1] Bulletin 16 of the U.S. Bureau of Mines, by Dr Charles A. Davis, 1911, contains a large coloured map showing the distribution of peat in the United States. The Canadian deposits are still more extensive.

is less than 55° F., and the growing season not more than half the length of the year: climates pretty well suited for apples but not for cotton.[1]

This species is rather sensitive to fire, at least when young, and perhaps up to middle age. In northern lower Michigan, and doubtless elsewhere, there are large areas said to have been covered with white pine forests up to about thirty years ago, when the lumberman came along and felled them. Since then fires, mainly of human origin, have been too frequent to allow the pine to reproduce itself except in protected places like islands and shores of lakes and streams, and the uplands are covered with a worthless scrub of birch, aspen, bird cherry and other fireweed trees, averaging about 10 feet in height.

The white pine is one of the world's most important timber trees. It was originally so abundant, and its wood is so easily worked, that it has been used for almost every purpose that does not require great strength, hardness or durability. Millions of houses have been built of it, and probably hundreds of millions of dry-goods boxes. On account of its growing within easy reach of some of the oldest and most thickly settled parts of this country, the value of its lumber which has been placed on the market in the last 300 years doubtless exceeds that of any other North American tree.[2] At the present time the leading states in the production of white pine lumber are Minnesota, Wisconsin, Maine, Michigan, New Hampshire, Massachusetts, New York and North Carolina, in the order named. But if the figures for the last census had been computed on a basis of equal areas, Massachusetts would rank first, New Hampshire second, and Minnesota third.

The Red or "Norway" Pine (*Pinus resinosa*) has a range approximately concentric with that of the white pine, but smaller. It is confined to the glaciated region, except that it has been reported from two or three countries in central Pennsylvania and one in West Virginia. In some places in the neighbourhood of the upper Great Lakes it forms pure stands with little under-

[1] The range of the white pine perhaps does not overlap that of the cotton crop at all, though they can be seen within a mile of each other at the western base of the Blue Ridge in northern Georgia.

[2] For valuable notes on the economic history of this and other pines see Bulletin 99 of the U.S. Forest Service, by Hall and Maxwell, 1911.

growth,[1] something like the long-leaf pine forests of the south; but it is more commonly mixed with Jack pine, white pine, or other trees. It grows in dry, usually sandy, soil nearly devoid of humus. Its climatic relations are perhaps sufficiently indicated by its distribution.

This species withstands fire almost as well as some of the southern pines to be discussed later, and it resembles them also in general appearance. In mature trees the branches and foliage are too high up to be injured by ground-fires, and the bark is thick enough to be reasonably fireproof. But even when the bark is burned through by a severe fire, making a large scar, the tree is not necessarily killed. At what age it becomes immune to brush fires has not been determined, but in the devastated pine lands of Michigan above mentioned there are many vigorous red pine saplings among the birches and aspens, as well as occasional tall trees of the same species which must have survived many fires.

The wood is so similar to that of the white pine that it is not usually distinguished in the lumber market or in the census returns. But reports on the wood-using industries of Michigan, Wisconsin and Minnesota, prepared in recent years by members of the U.S. Forest Service and published by the respective states, give the amount of each kind of wood used by manufacturers (*i.e.*, that which passes beyond the stage of rough lumber, even if it is merely planed) in each state in a year, and distinguishes between lumber cut within the state and that brought in from other states. From these we learn that the manufacturers of Michigan use in a year about 10 million feet of home-grown red pine, those of Wisconsin something over 6 million, and in Minnesota 167 million. (The corresponding figures for white pine are 70, 72 and 455; and both added together are less than half the total lumber production of the two species for these states as reported by the Tenth Census.)

[1] There are two illustrations of such forests in Minnesota in *The Popular Science Monthly* for November 1912 (p. 535), and another on page 10 of a report on the Wood-using industries of Minnesota, published by the State Forestry Board in 1913.

(*To be continued.*)

NOTES AND QUERIES.

The Great War.

The Society's Roll of Honour.

Fourth List.[1]

Campbell, Adam, Cromartie Estates Office. Corporal, Highland Light Infantry.

Clarke, Ian A., Chanonry, Old Aberdeen. Lieut. 4th Bn. Gordon Highlanders. (Twice wounded.)

Colam, R. Leigh. Lieut., Headquarters Eastern Command.

Dalzell, Sir James, Bart., of Binns. Major, 3rd K.O.S.B., attached to 1st Garrison Royal Scots.

Duthie, Edwin C., 33 Duthie Terrace, Aberdeen. Private, M.S., A.S.C., attached 5th Australian Division.

Edwards, Johnston, Pollok Estate. Private, 2nd Bn. Scots Guards.

Forsyth, J. A., Assistant Forester, Panmure Cottage, Montrose. Bombardier, R.G.A.

Gordon, Gregor, Huntly Hill, Brechin. Private, 3rd Cameron Highlanders.

Graham, R. F., of Skipness. 2nd Lieutenant, 3/8 A. & S. Highlanders, attached to 2/5 Durham Light Infantry.

Healy, Thomas, formerly Assistant Forester, Donamon Castle, Roscommon, Ireland.

Kay, John, Grangemuir, Prestwick. Private, T.R., 2/1 Highland Light Infantry.

Keir, James S., Borrodale, Arisaig. Private, 3/1 Scottish Horse.

M'Hardy, James, late of Forglen. Private, K.O.S.B.

Newton, James A., B.Sc., Assistant Conservator of Forests, B.E.A. 2nd Lieutenant, R.F.A.

Noble, H. C., Cantray Estates Office. R.F.A.

Ogilvie, John, Solicitor, Dundee. 2nd Lieutenant, North Scottish R.G.A.

Rillie, Joseph, formerly Assistant Forester, Acklam, Middlesbrough. Gunner, R.G.A.

Robson, R. M'Kinnon, 46 Belgrave Terrace, Aberdeen. Corporal, 2/3 Royal (London) Fusiliers.

[1] For First, Second, and Third Lists see Vol. xxix. p. 192, and Vol. xxx. pp. 47 and 129, respectively.

RUDDIMAN, William, Assistant Forester, Bowmont Forest. (Killed in France.)

SCOTT, Frank, Scone. M.G.C., 6th Lincolnshire.

SIMPSON, Robert, Under Forester, Airth Estate, Larbert. R.F.A.

TAYLOR, Robert, Foreman Forester, Moss-side Almondbank, Perth. Private, R.F.A. (T.).

WHYTE, James, formerly Assistant Forester, Donamon Castle, Roscommon, Ireland. (Wounded.)

YOUNG, James W., Factor, Kinneil Estate, Bo'ness. 2nd Lieut., R.F.A.

CORRECTIONS ON PREVIOUS LISTS.

CLARK, Wm., Dunglass, now 2nd Lieutenant, 4th (Res.) Bn. Royal Scots.

COLSTON, W. G., Rosemount, Lockerbie, now 2nd Lieutenant, Cameron Highlanders.

FORESTRY AND YOUNG PEOPLE.

Two members of the Society, Mr William Rowan Thomson, Marine Engineer, Glasgow, and Mr Andrew Hamilton, Marine Architect, Glasgow and Liverpool, generously sent handsome donations of £25 each to the Society, to be employed in creating an interest in afforestation among children. The way in which the money should be spent was left to the discretion of the Council of the Society. A further gift of £25 was subsequently received from another member, Mr J. L. Gray, Elginhaugh, Dalkeith, who approved of the idea.

The Council, after considering the various ways in which the money might be laid out, decided in favour of a small book, which should describe the objects and methods of forestry in such a way as to make them intelligible—and interesting—to young people. The President, Sir Andrew N. Agnew, Bart., was invited to write the book, and it is now in the hands of the publishers, Messrs Douglas & Foulis. It is written in simple language, and has been kept as free as possible from technical terms.

Dr A. W. Borthwick, D.Sc., Forestry Advisory Officer to the Board of Agriculture for Scotland, has given advice and assistance on all scientific points.

It is hoped that teachers in country schools may be persuaded

to take an interest in the scheme, and to bring the subject to the notice of their scholars. It is expected that the book will be published early in the present year, and that a certain number of copies will be available for free distribution, but as the price, in stiff paper covers, is to be 1s. only, it will be within the reach of all. Members should send their orders to the publishers at 9 Castle Street, Edinburgh, either direct or through a bookseller, without delay.

The Council will be glad to receive donations from other members who approve of this scheme, so that the scope of the work may be extended and enlarged.

The Planting of Berry-bearing Trees round Coniferous Woods.

This is more of a question than a suggestion, and more of a question for a naturalist than a forester, but it has occurred to me that it might be an advantage to plant such trees and shrubs on the margins of coniferous woods as would be likely to encourage small birds to live in their vicinity. If such trees as rowans, thorns, hollies and other berry-bearing shrubs were planted round the margins, it seems to me that the small birds would be encouraged to live about the edges of woods, which would be the better for their presence, and yet at present are not suitable for them. These trees would be useful, too, if they were firm-rooted, as a protection against windfalls. In Scotland the thorn and the rowan have plenty of berries, and are hardy and wind-firm; the holly does not carry so many berries, but some of the wild roses carry plenty of fruit that the birds are very fond of. On the other hand, brambles would have to be avoided owing to their habit of spreading when conditions are favourable to their growth. W. Steuart Fothringham.

Forest Surveys.

The evidence given before the Coast Erosion Committee as to the area available in Scotland for afforestation shows that while an area of 9,000,000 acres was reckoned as available, one witness put the estimate as low as 3,000,000 acres. It has been suggested that the larger estimate probably includes a considerable area suitable for agriculture, but it is much more

likely that both the witnesses included a much larger area that is at present used for sheep-grazing, but which would not be suitable for raising corn crops. However, that is not the point, but the very large difference in the estimates of the area that might be devoted to forestry is one of the strongest arguments that has been produced for undertaking a survey of the land in question, for the large discrepancy points to the guess-work nature of the evidence. The petition for a general survey put forward by the Royal Scottish Arboricultural Society, which was actually carried out by Lord Lovat and Captain Stirling in Glenmore, is the sort of survey that is required before any one can say what land is available for forestry in the country. Such a survey would be useful from many points of view, but in order to be of the greatest use, it would have to be carried out by men who had a knowledge of both forestry and sheep-farming, and who were not biassed in favour of one or the other, for it is obviously necessary to maintain or increase the number of sheep in the country as well as to increase the amount of home-grown timber. The sooner such a survey is undertaken the better for the prospects of systematic forestry in these islands. If a man is going to undertake any commercial business, he must first find out what materials he has to deal with, and count the cost, then lay out his plans and pursue them systematically. The same sequence applies to forestry; first make the survey and count the cost of the proposed undertaking, then make the forestry plan, and having made it, carry it out on a continuous system; in no other way can it succeed as a commercial scheme. One of the chief defects in forestry as carried out in this country is that it has been spasmodic, and the want of system has caused many people to think and say that forestry cannot pay; neither would gold-mining if it were carried out with the same want of method. But if and when a well-considered scheme is carried out, there is no doubt that a fair return will accrue to who ever carries it out.

This survey will, however, take time, and the question remains, What can an owner of woodlands do in the meantime to increase the supply of home-grown timber? I suggest that at present, when there is a great demand for all sorts of timber, owners should cut and sell those parts of their existing woods that have been overthinned in the past and no longer carry a full crop, for boards or sleepers or whatever they are fit for, and also cut

younger plantations, which show no signs of growing fit for anything better, for pit props. The first class should be planted again as soon as possible; in the second class, it may be that the plantations had no chance of success from the start from various causes, such as lack of soil or the planting of species not suitable to the site, in which case the area should be either returned to growing such herbage or heather as it will carry, and devoted to grazing, or replanted with suitable species. If our woods that have been neglected and overthinned in the past were now carrying a full crop, the supply of home-grown timber would be much greater than it is without reducing the area available for sheep-grazing.

The Board of Agriculture might, at the same time, carry out investigations for the improvement of sheep-grazings, so that the number of sheep in the country might be maintained, even though a considerable part of the grazings were taken for afforestation. It might well be that the shelter afforded by large plantations would be one of the means by which this increase might be obtained, but, so far as I know, nothing has been done in this direction except a very moderate amount of heather burning, and that in a spasmodic way, as the time of year when it may legally be carried out is limited to a period that is not always the most suitable. W. Steuart Fothringham.

The Relation between the Price of Coal and of Pit-wood.

The extent to which the price of coal has been affected by the increase in the prices of pit-wood is a matter of considerable interest to every one and especially to the forester. The following note shows, in an interesting manner, the relationship between the prices of the two commodities. For the purposes of comparison it is assumed (*a*) that it takes 6 to 8 lineal feet[1] of all classes of pit timber to raise one ton of coal, and that, therefore, an increase of 1s. in the price per 100 lineal feet of pit-wood is equal to an increase of $\frac{2}{3}\frac{1}{5}$d. in the price per ton of

[1] The number of feet of pit-wood required to raise one ton of coal varies according to the seams being worked. 6 to 8 feet per ton is believed to be a fair average, and was given by coal-owners. It is understood that in some mines two, three, or four times this quantity is necessary, while in others less than 6 feet may be required.

coal; (*b*) that, for the purpose of these calculations, short props only are used, the pit timber referred to in (*a*) being mostly of this type.

The following table shows the relative effect on the price per ton of coal of an increase in the price per 100 lineal feet of each class of prop, assuming that the 6 to 8 lineal feet used consisted only of this class.

As, however, the proportion of each size used varies, the increase must be averaged over all the sizes, and from the table it will be seen that the average increase per ton of coal does not exceed 5d. One of the classes of props, it will be observed, increased in price more than 100%, while the others are well above 50%.

For the purposes of comparison, the following actual retail prices of coal are also given:—

September 1914	. .	20s. per ton, dvd.
June 1916.	. .	30s. ,,
	Increase	10s.

Of this 10s. only 5d. (or a little over 4%) is due to the increase in the price of pit-wood.

TABLE REFERRED TO.

Sizes		Proportion[1] of each size generally used	Prices[2] D/d per 100 lineal feet		Increase in price per 100 lineal feet		Relative increase in price per ton of Coal	Average increase in price per ton of Coal
Dia.	Length		Sept. 1914	June 1916	Actual	Percentage		
Ins.	Short lengths up to 6 feet	%	s. d.	s. d.	s. d.		d.	d.
2		3	3 6	5 3	1 9	50	1·47	
2¼		15	...	6 5	...	...	...	
2½			5 0	7 11	2 11	58	2·45	
3		45	5 10	10 0	4 2	71	3·5	4·34
3½		20	6 10	12 11	6 1	89	5·11	
4		12	8 0	17 1	9 1	114	7·63	
4½		5	10 6	20 6	10 0	95	8·4	

[1] The proportions indicated are those contained in the Acland Award of June 1916.

[2] The prices quoted are for September 1914 and June 1916, the former being the first organised prices in Scotland between the Scottish home-timber merchants and the Scottish coal-masters, and the latter being those fixed by Mr Acland when he arbitrated between the same parties in a subsequent contract. These figures for June 1916 may be said to be the highest average prices reached for pit-props in the first two years of the war, although instances are known where even these prices were exceeded.

Death Duties on Woods.

(See articles on pp. 133-137 of Vol. XXIII., and on pp. 36-40 of Vol. XXVII.)

Further letters have passed between the Secretary of the Society and the Estate Duty Department on this subject, and the Department has now agreed that the deductions to be allowed from the proceeds of timber sold in respect of "necessary outgoings since the death of the deceased," will be held to include all expenses necessary to maintain the woods in the condition in which they existed at the death, such as the wages of foresters and woodmen, cost of pruning and cleaning, of fencing for protection, and of the killing of vermin, and outlays for seeds and plants, and the upkeep of a nursery, besides the cost of the felling where borne by the seller, the restoration of damage to fences, etc., and rates and taxes applicable solely to the woods; but not rent unless actually paid. The cost of replanting denuded areas is thus covered by the Act, but unfortunately the cost of planting new or extended areas is not covered.

Where the deceased owned different estates they form an aggregate for determining the rate of duty.

Only the net moneys received on sale are chargeable with duty, so that timber used for estate purposes does not require to be accounted for, because that timber goes to increase the value of the other property. R. G.

Diseases of the Common Spruce (*Picea excelsa*): Observations in Darnaway Forest.

Fungi claim many victims in a close-grown spruce crop. For example: *Trametes radiciperda* seems to attack the healthiest and best-developed specimens. This fungus is always present in the plantations, and sporophores are freely produced in burrows, and on the sides of open drains. The spruce needle-rust, *Chrysomyxa abietis*, is found in different localities here, but seems confined to old mature trees or stunted suppressed specimens. Alongside one of these mature infected spruces, a small area was planted two years ago with five different species of *Picea*, but as yet no signs of susceptibility to this fungus have been shown. *Lophodermium macrosporum* is somewhat virulent on the needles of a pure spruce crop of thirty-eight years of age.

The foliage of individual trees becomes quite red, and on shaking the tree the needles fall in showers to the ground. On many of the spruce needles the conspicuous black *perithecia* are present. A part of this wood was felled for pit-wood, and I found that this disease was alarmingly prevalent. It had been the direct cause of the death of many flourishing trees.

During February 1916, when one of the sections of the forest, which contains a mixed crop of Scots pine and common spruce, was being thinned, I observed that many of the spruce buds had for some reason decayed. On a few of these spruce, which are about seventy years of age, the buds were completely enveloped by a thick black crust-like stroma, on which were numerous black *perithecia*. These seemed to indicate an attack by a Cucurbitaria similar to *Cucurbitaria piceæ*, the conifer bud disease, described by Dr Borthwick in "Notes from the Royal Botanical Garden, Edinburgh (1909)" as attacking the buds of *Picea pungens*. The presence of this disease on the specimens of common spruce, which I sent, has been confirmed by him.

Damage to the spruce by insect attack is not found extensively, but *Tortrix tedella* is certainly increasing. The majority of the trees here have clusters of their needles hollowed out, and bunched together by this small larva. The foliage of a badly attacked tree becomes quite conspicuous by the light-coloured patches of these clusters of needles.

The Scolytidæ are represented by *Hylastes palliatus*, *Trypodendron lineatum* and *Cryphalus abietis*, which, however, confine their attacks to dying trees. *Chermes abietis* with its disfiguring gall is very prevalent, and attacks both common and Sitka spruce. Cones are seldom found without the destructive borings of the larva of *Tortrix strobilella*. This voracious larva tunnels through seed and scales, and reduces the interior of the cone to powder. It is indeed the exception to find a spruce cone which is not more or less destroyed by the larva of this small moth. H. Watson.

The Poplar.

As the poplar is now very generally recommended as a valuable tree to grow in suitable places on account of its rapid growth and utility for many purposes, the following experience may be to some purpose.

In the land I hold there is a small swamp. It has a depth of from 2 to 5 feet (and more in places) of liquid mud; below the mud is solid rock. Into this cattle and sheep occasionally strayed, and had to be salvaged with ropes and imprecations. I sawed off long branches of the black poplar, 8 feet or 10 feet long, sawing on the slant to give a point to the butt, and plunged them into the mud as far as they would go, or till they reached the rock. They never went back in growth for a day, and are now fair-sized trees, as well as the willows I treated similarly. As the ground became firmer there were added ash, sycamore, etc., and trespass has been barred.

This is not quite all the benefit. A path was needed through the swamp, and for years I had poured in every sort of rubbish, which naturally disappeared rapidly in the swamp. But when the poplars and willows began to grow, their roots interlaced themselves under the pathway and formed a sufficient network to retain the stones, old tins, bottles, oddments and cinders, which are now a solid path.

There must be very many areas, small and large, in Scotland which would well repay the slight labour involved in this treatment. Slips of poplar can be of any length and of a thickness up to that of a man's thigh. In fact the longer and thicker they are the better, in order to obtain quick results, provided the soil is sufficiently and constantly moist—apparently it cannot be too wet to arrest growth—and its surface is continually raised, and to some extent dried and rendered firmer, by the humus annually deposited.

MARTIN MARTIN,
Lieut.-Colonel.

REVIEWS AND NOTICES OF BOOKS.

Tree Wounds and Diseases, their Prevention and Treatment, with Special Chapter on Fruit Trees. By A. D. WEBSTER. London: Williams & Norgate.

The author's reasons for writing this book are: (1) that no work of a similar kind has been published; (2) that numerous inquiries as to the treatment of tree wounds and diseases suggest that such a book is required; and (3) the writer's knowledge of the subject, the result of many years' practical work and

observation, has caused him to relate his experiences in the matter.

This book is the outcome of the author's long and intimate connection with the care and treatment of trees for ornament as well as for use. The information given will be found very helpful by those responsible for, and interested in, the preservation and maintenance of valuable specimen and park trees. The practical operations to be adopted, on the most up-to-date methods, for the treatment of decaying trees, hollow trunks, supporting heavy branches, injured bark on root and stem, and the pruning of diseased trees, are fully described. The accuracy of the information given, and the value of the methods recommended, are greatly enhanced by the fact that the author has himself tested and demonstrated all that he lays before his readers. The illustrations, which are well chosen and reproduced, will be found of great help in following the text.

Chapters are added which deal with injuries caused by fungi, insects, animals and birds, together with appropriate preventive, and remedial measures. The chapter on fruit trees and their enemies will interest growers of fruit. Appropriate preservative materials and their proper use are also dealt with.

Perhaps the scientific physiologist and anatomist might take exception to some of the more technical parts of the book, and while there may be ground for criticism by such experts, we do not think that the practical value of the book suffers much. We accept the book as an account of the actual experience of a practical operator, and not as a work on research, and as such it will be found of use to those who wish practical guidance in dealing with the prevention and treatment of wounds and disease.

British-Grown Timber and Timber Trees. By ANGUS D. WEBSTER. With 41 full-page plates. London: William Rider & Son, Limited, 1916. Price 5s.

The present work is a useful addition to forest literature. The author has succeeded in presenting, within reasonable space and in an interesting manner, a large amount of information regarding home-grown timber.

The book is well planned. The species dealt with are arranged in alphabetical order, and a concise account is given of each.

Much genuinely useful information is given concerning the physical qualities and the technical applications of British-grown timber. The author has further added to the value of the book by giving what cannot fail to be of great interest to both grower and consumer, namely, the recent prices which have been obtained for timber of home production.

At the end of the book are added very useful articles on—Charcoal-making, Coppice and Underwood, Harvesting of Oak Bark, Firewood and Faggots.

In the Introduction a strong case is made out for the necessity of increasing our supplies of British-grown timber, and especially for greater care in conversion, seasoning and grading. The supposed inferiority of home-grown timber is mainly due to neglect of these important factors in its preparation. The illustrations of longitudinal sections of the woods dealt with show, generally, the growth and grain of the different species.

This book appears at a very opportune time, and cannot fail to fulfil the important object for which it was written, namely, to give in a concise form a descriptive account of all home-grown timbers that are of value for commercial and industrial purposes.

The Testing of Forest Seeds during Twenty-five Years, 1887-1912. By Johannes Rafn.

The above interesting and instructive work by Johannes Rafn, the well-known Danish seed expert, was printed for private circulation. Through a long period of years the author has studied all phases of the seed question, and especially whatever pertained to the improvement in quality and supply of forest tree seeds.

In all plantings and afforestation, generally, it stands to reason that much of the success or failure is bound to be closely related to, and dependent on, the quality of the seed from which the plants used originated. This fundamental fact was early recognised by Johannes Rafn, who was one of the pioneers in the development and perfecting of methods of seed-testing. The present work gives a large amount of most valuable information and statistics concerning the seed of all the forest trees cultivated in Europe.

The seeds of the various forest trees of different parts of the world are considered in various sections. Section I. deals with European, West Asiatic and North African conifers. Section II. is devoted to American conifers. Section III. treats of Japanese (East Asiatic) conifers. Attention is also given to the seeds of the broad-leaved trees of European, North African, and West Asiatic species. The eucalypts of Australia are treated of separately.

At the end tables are given where all the information concerning the weight, purity, percentage of germinating capacity, etc., is given in concise and readily available form. A fact, which adds great value to this excellent book, is that the information given is based on the knowledge gained after twenty-five years practical experience of the subject by an expert.

Seeding and Planting: A Manual for the Guidance of Forestry Students, Foresters, Nurserymen, Forest Owners and Factors. By JAMES W. TOUMEY, M.S., M.A., Director of Forest School and Professor of Silviculture, Yale University.

As the title suggests this work will appeal to a wide circle of readers. The need of a book of this kind has long been felt, particularly in the United States, and especially since it has been recognised that the rapid inroads which have been made upon the virgin forest by axe and fire seriously hinder or entirely exclude the hope of satisfactory natural regeneration.

To those who are interested in afforestation problems pertaining to the State, a very interesting discussion will be found in the introduction, which deals with the economic importance and the present condition of the forests of the United States, and especially with the need for artificial regeneration. The book is divided into two parts.

Part I. is devoted to fundamental principles of regeneration. A clear and interesting résumé is given of the methods of natural regeneration from seed, by the recognised methods of cutting to secure this object. The effect of the various external factors, climatic and organic, which influence the growth of seedlings, and, therefore, which necessitate a careful and intelligent choice of the right kinds under any given set of conditions, and the methods by which they should be treated, are fully described.

Part II. deals more especially with the problems of artificial regeneration. This part contains a large store of valuable information about seed, seedlings and nurseries. The reader will here find facts concerning seeds and seedlings well arranged and clearly described, which he may vainly seek for elsewhere. Space prevents our going into further details, but it can be definitely said that nothing has been omitted which has a practical bearing on artificial regeneration.

The book is profusely illustrated by well-chosen and beautifully reproduced photographs. The student of silviculture will find much to interest him in the pages of this book, which forms a valuable addition to a section of forestry literature which has been rather neglected in the past.

OBITUARY.

By the death of Mr A. T. Gillanders, the Royal Scottish Arboricultural Society has lost an eminent and highly esteemed member.

Mr Gillanders was a member of the Society for nineteen years, and during that time he gave freely of his valuable services in all matters relative to the welfare of the Society, and the advancement of forestry, sparing neither time nor trouble in the interests of either. He served on the Council of the Society until quite recently, and was also a member of the Council of the Royal English Arboricultural Society, Forestry Examiner for the Highland Society of Scotland, and held many other important positions.

Mr Gillanders was fifty-seven years of age at the time of his death, which occurred suddenly on the 15th of July, through an attack of heart trouble, and it is a matter of sincere regret that the services of such an enthusiastic and practical forester should be lost, especially at a time when forestry has a more promising future.

Mr Gillanders was a native of Drumlithie, Kincardine, and commenced his forestry career as an apprentice on the Durris estates, Kincardineshire, where he remained four years. Removing to Edinburgh, he worked in Messrs Dicksons' nurseries, subsequently taking a situation as under-forester at Cathcart,

near Glasgow. He afterwards served as head forester at Skibo, Ross-shire, and later became head forester at High Leigh, Cheshire.

While occupying this post, he improved his knowledge on all forestry subjects, and showed a special interest and aptitude in the study of insect life, thus laying the foundation of his valuable work, *Forest Entomology*, which is recognised as a standard work, and which was awarded a gold medal by the Royal English Arboricultural Society. The success of this book was very gratifying to him, as an enormous amount of work was involved in the collecting, breeding, and rearing of the different kinds of insects, and the study and observation of their habits, in order that first-hand knowledge might be obtained. This branch of natural science appealed most strongly to him, and he was always delighted to receive a specimen of any of the many forest pests. In recognition of his valuable services in the interests of forest entomology, he was made an honorary member of the Royal Scottish Arboricultural Society, the highest honour the Society can bestow.

On leaving Cheshire, he was appointed head forester to the Duke of Northumberland on the Alnwick Castle estates, a position which he filled for a prolonged period, and where he found an outlet for his boundless energy, his inventive faculties, and his many-sided ability. Entering heart and soul into the work, Mr Gillanders set about improving and renovating the extensive woods on the ducal estate, the improved and thriving condition of the plantations being the best tribute to the skill and care bestowed on their culture. He re-erected the estate saw-mill on a much larger scale, fitting it up with all the latest improved wood-working machinery, capable of turning out, in a finished condition, everything required for estate purposes, and forming a source of considerable profit, as well as being a model of its kind. He also installed a pressure creosoting plant, which was always kept fully occupied, and the various nurseries laid out and formed under his supervision, largely supplied the needs of the estate, as well as being a source of interest. Many of the young men who worked under him have cause to remember, with gratitude, the kindly counsel, the careful, practical knowledge so ungrudgingly imparted, and the help towards securing a higher position which he was always so ready to give to those who took an interest in their work. Nothing gave

him more pleasure than to see one of his "young men" appointed head forester.

Mr Gillanders had the supervision of a very large staff of men, and succeeded in imparting much of his own energy and enthusiasm into them. The work he carried out on the Alnwick estates will remain as a lasting tribute to his sterling worth.

On leaving Alnwick to fill the position of woods manager to the Duke of Somerset, Mr Gillanders was the recipient of several handsome presents, amongst them being a copy of *The Trees of Great Britain and Ireland*, by Messrs Elwes and Henry, presented to him by His Grace the Duke of Northumberland, as a mark of appreciation of his valuable services. Of his short time in Somerset very little can be said, but the Duke and Duchess of Somerset both expressed unqualified approval of his work and plans for the future management of their interesting woodlands. Mr Gillanders wrote many instructive articles to the various forestry publications, and had he been spared would, no doubt, have written more. He leaves a wife and two daughters, with whom much sympathy is felt in their bereavement.

G. Mowat.

We regret also to have to record the death of Mr W. M. Gilbert, Chief Reporter of the *Scotsman*. Mr Gilbert took an active interest in forestry and all that pertains to its progress and development, and in this connection he maintained a constant interest in the affairs of the Royal Scottish Arboricultural Society. Many members will remember his presence at the annual excursions of the Society, and although in later years he was less able to take part in the more strenuous expeditions, he still kept himself in touch with forestry matters through his many friends and correspondents.

Mr Gilbert, who was 65 at the time of his death, was a native of Aberdeen, and began his work as a reporter in that city on the staff of the *Aberdeen Journal*. He came to Edinburgh forty-three years ago, and joined the *Scotsman* staff in 1873. During his long period of work in the city he made many friends, and his loss will be regretted by a large circle. He leaves a widow, one son and two daughters.

TRANSACTIONS

OF THE

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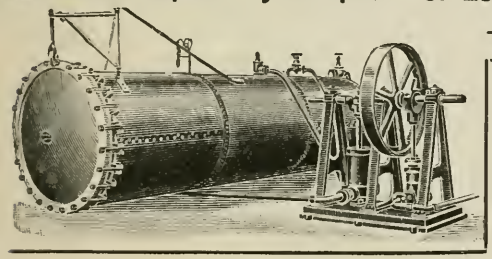

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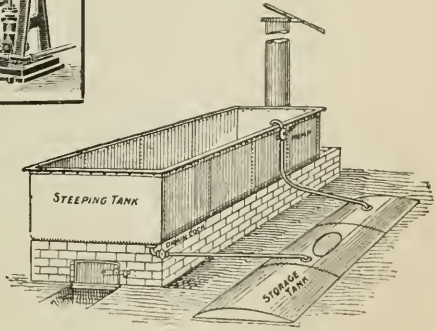

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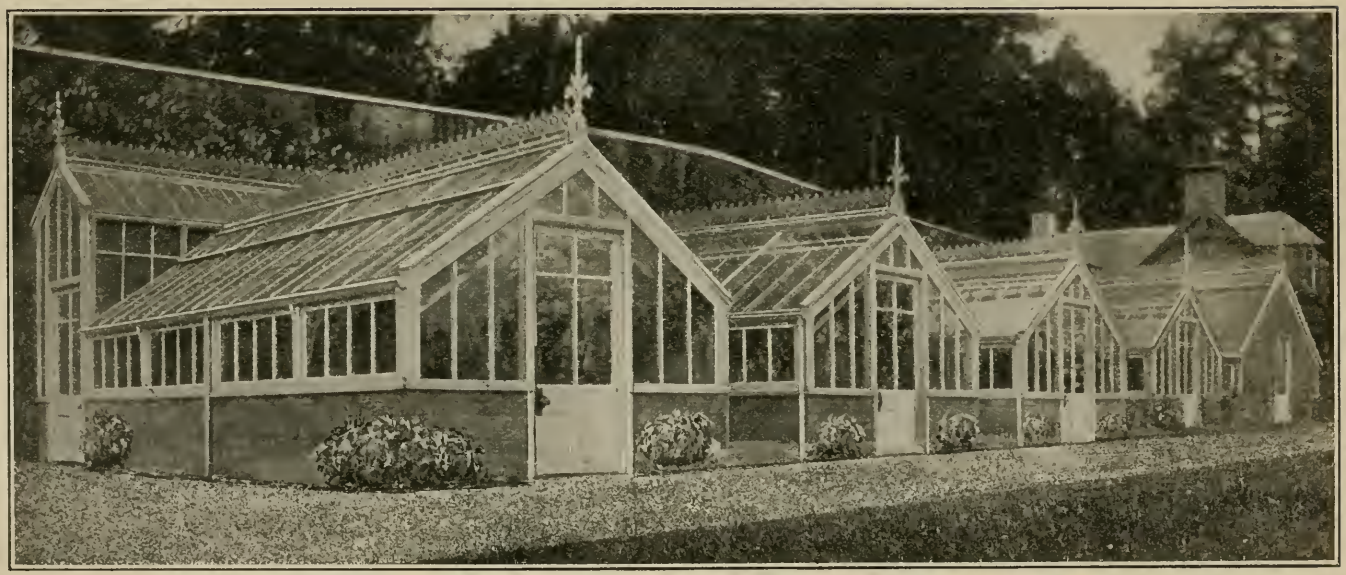

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TRANSACTIONS

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ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

16. Statement by the Council regarding Afforestation.

The following statement contains the recommendations of the Council of the Royal Scottish Arboricultural Society regarding afforestation, in reply to a letter from the Secretary of the Forestry Sub-Committee of the Reconstruction Committee, asking for an expression of their views on the subject.

1. Need for Action by Government.

After the reports of a Royal Commission on Forestry and of more than one Departmental Committee on the subject, it would be superfluous to discuss either the need for further afforestation, or the duty of the Government to assist in the work. The simple fact that we spent more than 40 million pounds in 1913 upon imported wood, is sufficient to show, both the enormous extent to which the home-grown supply falls short of our requirements, and the impossibility of expecting private effort to make up the deficiency.

The question has attracted a good deal of attention in recent years, and all who have studied it have been struck by the great loss which the nation suffers in paying away to foreigners immense sums of money which might be retained in the country for the benefit of its own people. And since the war began we have had occasion to feel that our reliance upon foreign countries for such a large proportion of our timber requirements is not only a material loss but a source of danger.

How dependent we are upon wood is, perhaps, not sufficiently appreciated. It is not too much to say that civilized life could not go on without it. The amount required by railways, collieries, and other vital industries is gigantic; and to these must now be added the enormous consumption of wood in

modern warfare. To induce the Government to embark upon a policy of afforestation stress is often laid upon the fact that national forests would prove a source of revenue. Judging from the published accounts of French and German forests, and from the experience of landowners in this country whose woods have been scientifically managed, there can be little doubt that this would eventually be the case. But it is not on this ground that the decision of the Government should be based. The true justification for national afforestation is the well-being and security of the country. Wood is one of the prime necessaries of life. Next to food, it is the article of which an abundant supply is most essential to the nation. It is on this ground that foreign governments have recognised their responsibility in the matter; and it is on this ground also that we hope our Government will decide to do the same.

The country has been informed that it is the intention of the Government to make every available acre of land productive. This can only be done with the aid of afforestation. There are, no doubt, thousands of acres of agricultural land, now neglected, which are capable of being profitably cultivated. But beyond these, there are millions of acres of waste land capable of being profitably planted. Unless the Government will assist in planting them, one of the greatest natural resources of the country must remain undeveloped.

The benefits of national afforestation may be summarised as follows:—

1. It would turn many barren wastes into profitable woodlands.
2. It would retain, in the rural districts, thousands of men who now have to seek employment in the towns.
3. It would keep in this country, for the benefit of the country, millions of pounds now paid away to foreigners.
4. It would enable a large number of small holdings to be established on economic lines.
5. It would lead to the development of many new industries.
6. It would ensure such a supply of timber as would enable British industries to be carried on, without curtailment and without anxiety, in the event of another great war.

2. Extent of State Afforestation.

A preliminary point to settle is the extent of afforestation which would be required. It would be quite possible to make the country self-supporting in the matter of timber. The reports of the Royal Commission and Departmental Committees show that the amount of available land is more than sufficient for the purpose; while competent authorities assure us that our soil and climate will produce every variety of timber in common use, and of a quality equal to that which comes to us from abroad.

It would not be necessary, however, to make ourselves entirely self-supporting. It would probably be sufficient to make such an increase in our existing woodlands as would substantially diminish the amount which we now pay annually for imported timber, and enable us, in the event of another great war, to carry on for three years without unduly depleting our home supplies. To ensure this our present woodlands should be increased by 2 million acres. The wooded area of the United Kingdom is estimated at 3 million acres: it should be increased to 5 million acres.

The annual consumption of timber in the United Kingdom before the war was about 650 million cubic feet. Of this amount only about one-eighth was grown at home. Under an improved system of silviculture the existing woodlands in the country would yield fully twice their present output. The additional 2 million acres, scientifically managed, could be counted on to yield 150 million cubic feet. We should thus obtain from the afforested land in this country something over 300 million cubic feet annually, or one-half the volume of present consumption instead of only one-eighth.

We do not say that an addition of 2 million acres to the area now under timber would fully meet the needs of the country, especially when we remember how the demand for timber has steadily increased; but we consider that this is the lowest figure which should be aimed at in any scheme of national afforestation.

3. Joint Action by State and Landowners.

Afforestation should be carried out, partly by the State, and partly by private owners of land. There is no doubt that the work would be more cheaply done if landowners were encouraged

to take a part in it. In the first place, where the work was done by landowners, the State would be relieved of all expense connected with the purchase or leasing of the land to be planted. And in the second place, owners already possess much experience in planting and managing woods, and they employ a large number of men trained in the arts of forestry. It would obviously, therefore, be an advantage to associate landowners, as far as possible, with any scheme of afforestation. The extent of afforestation contemplated is, of course, too large to enable them to undertake more than a limited share of it. But it would be worth while for the State to offer inducements to them to make the share as large as possible. These inducements should take two forms—(1) the removal of discouragements to planting; and (2) the offer of substantial encouragements.

Discouragements.

The chief discouragement to planting is due to the burden of imperial and local taxation. These two combined always amount to a very large proportion of the annual value of the land. At the present rate of taxation they often exceed 20s. in the pound, as can be proved by concrete instances. Such instances no doubt include super-tax; but it must be remembered that super-tax will invariably be payable on estates where planting could be done on a large scale. Unless this burden were lightened, it would not be possible for landowners to take any considerable part in the work of afforestation.

Local Taxation.—In Scotland the local rates are paid partly by the owner and partly by the occupier. Where land is let for pasture, the owner pays one-half of the rates and the occupier the other half. If the land is taken for planting, the owner not only gives up the rent he has been receiving, but he has to pay a double share of rates (as owner and occupier). As long as the land was in the farmer's hands, his rates were reduced by the Agricultural Rates grant; but the rates on the same land have to be paid in full as soon as the owner uses it for planting. These three things combined—loss of rent, payment of double rate, loss of the benefit of the agricultural grant—operate as a distinct discouragement to afforestation. In any reform of local taxation, the matter should be considered and set right. In the meantime this discouragement could be partially removed by

putting silviculture on the same footing as agriculture, and making the Agricultural Grant apply to all land used for growing timber for profit.

Income Tax.—Similar discouragement is caused in the case of income tax. Where land is left in agricultural occupation, and let to a tenant, the owner escapes all income tax under Schedule B. But as soon as he takes the land into his own hands and plants it, he becomes liable in respect of it to both income tax and super-tax. It is obvious that, with income tax and super-tax at present rates, this is bound to be a deterrent to planting.

To some extent the burden has been diminished by the provisions of Section 22 (4) of the Finance Act, 1915, which gives the owner the right, as regards existing woodlands managed on a commercial basis, to be assessed under Schedule D instead of Schedule B. The profits, however, under Schedule D are to be based on a three years' average only, which is too short a period in the case of timber crops: it should be at least five years.

Under Section 38, Sub-section (2) of the Finance Act, 1916, the owner may claim to have all replanted or newly planted areas treated as "woodlands on a separate estate," and assessed under Schedule D. This clearly gives immunity for income tax (but only as regards occupancy) until such time as the crop of timber begins to be saleable. The concession is certainly a valuable one, provided that all the expenses of planting and maintenance are allowed to be deducted before profits are reckoned. Otherwise the benefit is illusory. As there is some doubt upon the point, it should be cleared up without delay.

Death Duties.—Timber, like every other kind of property, is subject to the Death duties, and, under ordinary circumstances, there would be no ground for seeking exemption for it. But the State never dies; and if the State is to own forests, and to compete with private individuals in the sale of its timber, it will have an unfair advantage unless some change is made. It will therefore be necessary, either that standing timber should be exempted from payment of Death duties, or that the State should consent to be taxed for an equivalent sum every twenty or thirty years.

Encouragements.

The reasons for the encouragements suggested are—

1. That every acre of land planted is a gain to the country, and that this gain can be obtained more cheaply by inducing owners to plant than by the State buying the land and doing the planting itself.

2. That an immense quantity of timber has been felled to meet national requirements during the war, without any corresponding planting having been done; and that it is necessary to stimulate replanting.

3. That many persons who would be willing to plant are not in a financial position to do so; whilst others are not prepared to incur the whole loss of an outlay for which they cannot expect any return during their lifetime.

4. That from $2\frac{1}{2}$ per cent. to 3 per cent. is all the return that can be counted on for money invested in planting, and that for this return the planter must wait many years, whereas he can obtain an immediate return of 5 per cent. if he invests his money in other ways. That, therefore, if the State desires him on national grounds to invest his money in planting, it must offer him some compensation for doing so.

The following are suggested as inducements which might prove effective; and they should be given equally for the renewal of old plantations and the creation of new ones :—

1. A bonus of £1, 10s. per acre for every acre planted—the only condition in this case being an undertaking on the part of the owner that the trees selected shall be suitable, the planting properly done, and the young plants protected against damage by rabbits.

2. A bonus of £3 for every acre planted. In this case, besides the above-mentioned conditions, the Government would have, in the event of war, the first claim to the timber, at the average price of the three preceding years.

3. An advance of the whole sum required for planting, to be repaid, capital and interest, by annual instalments spread over a considerable period. This method may be preferred by a certain number of landowners, though the number may not be great at present owing to the high rate of interest prevailing.

4. Method of Acquiring Land.

Where afforestation is undertaken by the State, the land required for the purpose could be obtained either by purchase or lease. There is no reason why both methods should not be employed.

Purchase would be the simpler and more natural method. It would allow the State an absolutely free hand in dealing with the property, and would avoid all possible disputes and legal complications. The chief objection to it would seem to be the large initial cost. It might also be argued that the money might be better employed in getting on at once with the actual work of afforestation.

If land were leased by the State for afforestation, the lease should be a perpetual one, or something approaching to perpetuity. The land would then practically become the property of the State at a fixed annual rent, the sporting rights being reserved to the owner, unless the State should prefer to acquire them.

The State should have the right to put an end to the lease at any time, if the land were to prove unsuited for profitable planting. In that event, the lessor should have the option of having the land restored to him, either with the standing timber, or with the timber removed.

On the other hand, the lessor should also have the right to put an end to the lease at any time, on paying to the State the market value of the standing timber.

The question of giving the State compulsory powers for the acquisition of land need not be discussed at present. There will be no difficulty in obtaining, by voluntary agreements, all the land that will be required to start with. It will be soon enough to consider compulsion when voluntary arrangements show signs of failing. By that time the nation will have become committed to the policy of afforestation, and will have seen the work in progress; and the Government would find no difficulty in carrying public opinion with them in any measures that might be necessary.

5. Small Holdings.

Where the State acquires land for afforestation, it is desirable that there should be included in the area, as often as possible, a certain amount of land capable of being adapted to small

holdings. It is generally admitted that the creation of small holdings, where there is a prospect of their being profitably worked, is an object of importance on national grounds; and we are of opinion that in Scotland small holdings would be most profitably worked in connection with afforestation. The small holder would then not be entirely dependent upon his holding, but would be certain of regular employment at good wages during the winter months, when his farm required little attention. Afforestation and small holdings should therefore be considered together when land is being acquired. There are a great many farms in Scotland which contain a small proportion of cultivated land and a large proportion of unreclaimed grazing land. In such cases the joint purpose would be effected if the State were to acquire the whole farm, utilising the cultivated portion for small holdings and the remainder for planting.

6. Surveys.

As soon as afforestation is decided upon, the first necessary work will be a survey of the whole country. This at least will be the case in Scotland, where every county contains more or less land available for planting. There should, in the first instance, be a general "Flying Survey" of the whole country, indicating all the waste areas suitable for planting. This would be followed gradually by detailed surveys of selected districts, in which the flying survey had shown that there were suitable areas large enough to be included in a scheme of national afforestation. The Royal Scottish Arboricultural Society have published a detailed survey of the district of Glenmore, showing not only the land which might be profitably planted, but also the way in which such planting would affect the incidence of local taxation, the labour question, and all other existing interests. We consider that any detailed survey undertaken by the Government ought to deal with the problem on similar lines.

7. Starting the Work.

The immediate expenditure, when embarking upon a policy of afforestation, need not be formidable. As planting can only be gradual, the land need only be acquired gradually. It would not be necessary to have in hand more land than would be required for a few years' operations. If the Forestry Authority

made a point of always having enough for the operations of the succeeding ten years, this would probably be sufficient.

The surveys, the selection of areas to start upon, the purchase or leasing of the land, the formation of an efficient forestry staff, would occupy some time at the outset. And the actual work of afforestation would be better done if not too much were attempted at first. Planting should be done on a moderate scale for the first few years, advancing in pace as experience was gained, and as the supply of trained men was increased.

There would be an advantage in fixing at once upon a definite extent of afforestation to be aimed at, and a definite time within which the work should be completed. The extent might be, as already suggested, 2 million acres, and the time eighty years. Planting might then start at the rate of 5 to 10,000 acres annually for the first ten years; rising, as circumstances permitted, to a rate which would ensure the work being fully carried out within the prescribed period.

8. Forestry Authority.

If afforestation is to be carried out on a national scale, it will require to be placed under the control of an Authority whose sole business it will be to attend to it. The present position of forestry under the Board of Agriculture has proved unsatisfactory —at least in Scotland—for various reasons, and a change is urgently needed.

We are strongly of opinion that the best policy would be to create a separate Forestry Department for the whole of the United Kingdom. This would ensure a uniform policy and system of management for all parts of the kingdom, and a fair allotment to each country of work to be done and grants to be received. The actual work of afforestation would not be large at first, and might seem insufficient for a State Department, but it would require much forethought and preparation; and when once begun, it would grow rapidly in magnitude and importance.

The work can only be properly planned and successfully executed under the guidance of someone who is himself an expert in forestry; and you are seldom likely to be able to place at the head of the Board of Agriculture a man who is at the same time an acknowledged expert in farming and in forestry. It would, therefore, seem more business-like to separate the two

subjects, and to place forestry under a Department of its own, where it will be under the direction of men who have made it their special study. And we would add that, since the subject is such a technical one, those who are selected as competent to deal with it should be allowed a wide discretion, and not have their hands tied by restrictions or regulations beyond those that are considered necessary to ensure due economy.

Since the conditions affecting afforestation are obviously different in the different parts of the United Kingdom, it would probably be desirable that the Forestry Department should consist of three branches, with offices situated in England, Scotland, and Ireland, and a small Central Controlling Authority.

The duties of the Central Authority would be—

1. To form a comprehensive scheme of afforestation for the United Kingdom.
2. To allot to each of the three branches their separate shares in working out the scheme.
3. To consider and sanction plans laid before them by the branches.
4. To see that schemes were carried out in accordance with a consistent plan.
5. To allot to the three branches the sums provided by Parliament in proportion to the work done.
6. To authorise the purchase or leasing of land.
7. To have the direction of forestry education.
8. To see that efficient steps were taken in each country for training a sufficient number of foresters.

The duties of the Branch Departments would be—

1. To carry out the preliminary surveys.
2. To advise the Central Authority on questions of purchase or leasing in their respective areas.
3. To prepare schemes for planting suitable to the various areas selected.
4. To carry out such schemes when they have been sanctioned by the Central Authority.
5. To obtain and record all necessary statistics.
6. To be responsible for the disposal of timber in the woods under their control.

Should there prove to be objections of which we are unaware against the creation of a State Department for forestry, and should it be deemed advisable for forestry to remain under the Board of Agriculture, we consider it essential that there should be a branch of the Board dealing with forestry alone, and provided with a separate staff and a separate fund. This point has frequently been urged in the past by the Royal Scottish Arboricultural Society, and a promise was given by the Secretary for Scotland, as long ago as 1911, that the desired change would be made, but the promise remains unfulfilled. Failing an independent Forestry Department, it will be necessary that some such change should be carried out.

17. The Society's Annual Meeting: President's Address and Discussion.

At the Society's Annual Meeting, held on 7th February, the Chairman, Sir Andrew Agnew, in moving the adoption of the Report of Council, said:—"We have elected all the office-bearers for the ensuing year, and I have to thank you for the honour you have done me in re-electing me as President. I am very proud to accept your invitation and to continue as your President for another year.

"I should consider it a great privilege to occupy the position during the ensuing year if it should prove, as it seems likely to prove, a year of great importance to the cause of forestry. I think you will all have noticed in the speech which Mr Lloyd George made to the House of Commons, in which he announced the policy of the present Government, that one point that he insisted upon was that every acre of land in the country should be made productive. At the moment he was only referring, of course, to agriculture, but the principle that he laid down is just as applicable to silviculture, and I do not think that Mr Lloyd George would have any objection to that extension of it. Indeed, I think that we have reason to look upon his appointment as Prime Minister as being of great promise for the future of afforestation. He is the one important statesman who has shown any appreciation of the subject, and the only one who has made any definite attempt to deal with it. When

he instituted the Development Grant in 1909, he put afforestation in the forefront of the objects which were to be assisted by that grant. I should like to recall to you the words that he used on that occasion, because they acquire fresh force to-day now that he is in a better position than ever to have them carried out. After pointing out that we were behind every other civilized nation in the care that we took of our timber supplies, he went on to point out what were the objects that the Development Grant was intended to assist. 'The grant,' he said, 'will be utilised in the promotion of schemes which have for their purpose the development of the resources of the country, and will include such objects as the institution of schools of forestry, the purchase and preparation of land for afforestation, and the setting up of a number of experimental forests on a large scale.' Well, these words excited great hopes amongst all who were interested in the subject of afforestation. Unfortunately, for reasons which I will not enter into now, the result has been somewhat disappointing; but I think we may be sure of this, that the statesman who did his best to inaugurate a policy of afforestation eight years ago will not be less anxious to promote that policy to-day, and that he will lend a sympathetic ear to any practical proposals that may be laid before him. I believe that such proposals are likely to be laid before him very soon.

"I understand that the Committee to which Mr Galloway has referred in his report, a committee of highly-qualified men who were appointed last summer to consider the whole subject, have approached the conclusion of their labours, and will be presenting their report very shortly. I have great hopes that, as a result of that report, forestry will receive a great impetus, and that it will at length obtain the recognition which is due to it as a great national industry. If this should be so, there ought to be no delay in starting the work of afforestation. Trees will not grow in a day, and if this country is to be in a better position with regard to timber at the next great emergency than it was at the outbreak of the present war, we must lay the foundation for it now. Some people, I know, are sanguine enough to believe that this is going to be the last war, that its experiences have been so terrible and its sacrifices so immense that the world will not endure a repetition of it. I am afraid that is too good to be true. It is probably true that no one who is of mature age

to-day will live to see another great war, but there will come a generation after us to whom this desolating struggle is only a matter of history, and as long as human nature remains what it is there will always be quarrels which nothing but force can settle. We need not expect war, but we are bound to consider the possibility of it, and to make due provision to meet it; and one obvious provision, as every one realises to-day, is a sufficient supply of home-grown timber. If we were to start planting to-day there would be time to cover many barren hill-sides with useful woods before the next great crisis came; but even if such a crisis should never come, the policy will still be amply justified by the increased wealth that it will bring to the country, and by the opportunities that it will give of supplying the best asset a nation can have—a healthy and vigorous population.

"We are to have a discussion presently on some of the immediate problems of afforestation in this country. It seems a very opportune moment for such a discussion, for questions are sure to arise as soon as afforestation is settled upon, and it is very desirable that we should have clear views as to how these questions are to be dealt with. It is very interesting to see how this question of the timber supply is agitating other parts of the British Empire besides our own. Even in countries where the State has recognised its responsibility in the matter, there is a feeling that something more should be done than has been done hitherto. It is found that even in these States the Government is none the worse for a little stimulus from public opinion. We have received evidence of this quite lately from the other side of the world. Australia and New Zealand have both got their Forestry Departments, but in both of these countries there has been a growing feeling that not enough has been done in the matter. In Australia, where they have suffered a good deal from shortage of timber since the war broke out, a Central Forest League was founded a year or two ago to keep the subject before the public eye and to see that it was not neglected. I need hardly say that that Forest League has received the warmest support of the Governor-General, Sir Ronald Munro-Ferguson, who has done so much for silviculture in this country, and who has carried his enthusiasm with him to the great Dominion which he now governs. And now we hear of a similar thing being done in New Zealand. The fine forests of New Zealand have been so heedlessly destroyed

that the country is no longer self-supporting in the matter of timber, as it ought to be, and the question is realised as an urgent one by many influential people in the country. A Forest League has been formed in New Zealand also, for the purpose of co-operating with the Government in any measures that may be necessary. The Forest League of New Zealand is the youngest society of its kind in the British Empire, and our own society, the Royal Scottish Arboricultural Society, is the oldest. On the occasion of our Diamond Jubilee three years ago, the authorities in New Zealand showed their interest in a very friendly manner by sending a representative all that long way to take a part in our celebrations. Most of you will remember Mr Robinson, to whom you gave a hearty welcome, and who, I believe, has carried away with him some pleasant memories of his visit to Scotland. I hope you will agree with me that we might, in our turn, show our appreciation of the work that is now being started in New Zealand by expressing to the Forest League of New Zealand our lively interest in their aims and our best wishes for their fulfilment.

"I am sorry I have to conclude my remarks by referring to what you have already heard from Mr Galloway, that we have had a double disappointment to-day. We had hoped to have with us both Mr Sutherland, of the Board of Agriculture, and Colonel M'Dougall, who commands the Canadian Corps of Foresters. I regret to say that urgent public affairs have at the last moment detained both these gentlemen, and they have been unable to be with us to-day. We are always glad to have Mr Sutherland with us, and we had hoped to-day that he might have given us some idea of the views and intentions of the Government with regard to forestry. Colonel M'Dougall might have had something interesting to say to us, and, at any rate, we should have appreciated the opportunity of welcoming him here, and of acknowledging our debt of gratitude to the people of Canada for all they have done for us and the way they have come forward to help us in this great struggle. It is unfortunate that neither of these gentlemen is able to come, and I am afraid their absence will take away a certain amount of interest from the programme this afternoon, but I hope in the discussion we shall have on the problems of forestry, enough will remain that is useful as well as interesting for our proceedings this afternoon."

Dr A. W. Borthwick, in opening a discussion on "Our Afforestation Problems," said :—"Sir Andrew, ladies and gentlemen, in the very interesting remarks we have just listened to, your Chairman mentioned that the problems which we will have to consider seriously in the near future must be of a purely practical nature, and I hope this discussion will go along the same lines, that is, that we may discuss subjects in connection with the future of afforestation problems and make suggestions which will be capable of immediate application in practice, leaving academic subjects for other occasions.

"It was felt by the Council that at this time a general discussion on forestry problems by the members of the Society, at the General Meeting, would be more helpful to the cause of forestry than a formal address on some specific theme or phase of forestry development, which might be more or less limited in its general application.

"One effect of the present war has been to demonstrate, in an unmistakable manner, the vital necessity of maintaining sufficient forest reserves to supply the timber required by our essential industries, and also to meet the manifold requirements of our army in the field. The drain upon the existing resources has been severe, and no time should be lost in replacing those woods which are now being cut, and in developing the afforestation of new ground. These, then, will be our two main problems in the near future, *i.e.* replanting of old afforested areas and the extension of afforestation to new ground. These are, however, not new problems; but though old ones they now present themselves in a new light, and must be considered in the light of the very much altered conditions which now prevail. Never before in the whole history of our Society, or even of the country, has the importance of afforestation and timber production been more clearly recognised, nor have its problems been more pressing, than now.

"The final direct aim of afforestation is to produce timber, and the point cannot be too often repeated, nor too strongly emphasised, that the timber grown and produced must be of the right kind and quality, and that it must be available in sufficient quantity. Let it be recollected that our soil and climate are particularly well adapted to produce a larger variety of economic timber than any other European country, and further, that the timber produced in this country is equal

in grain and fibre to the best products imported from abroad.

"How then ought we to proceed in order to ensure, as rapidly as possible, that for all time to come this country may be made self-supporting as regards its necessary timber supplies? The answer to this highly important and seemingly difficult question is as obvious as it is simple, namely, that we ought to set to work now and do something practical, leaving all academic discussion to take care of itself in the meantime, and proceed on practical lines, based on past experience, with replanting and new afforestation on all areas known to be suitable for the purpose. The position of those new areas can be rapidly ascertained by means of a general or flying survey commencing in those parts of the country which offer the best facilities for a beginning being made, with a sure knowledge that the effort will lead to the desired result. A survey is necessary before it can become possible to arrange for the planting of sufficiently large blocks, so desirable for the well-being of the trees themselves, and also for the execution of every practical operation from the initial planting to the felling, conversion, and transport of the mature timber. Such surveys have already been too long delayed, and the sooner we begin to make up for lost time the better. I urge the importance of these surveys, and their necessity as the first step to be taken in the afforestation, on a large scale, of new areas; and although it is a subject which has long since passed out of the realms of discussion among foresters, and has become an accepted principle, I refer to these surveys on account of their importance.

"As regards the compilation of statistics and data for future use the present time offers unique opportunities. When so many woods are being felled all over the country, it is highly desirable that each estate should preserve as careful a record as possible concerning the kind and condition of every wood which is now being felled.

"The condition of the trees themselves, on any area, is the best and most reliable index of the capability of that area for timber production. Where mistakes have been made in the selection of species for any area, now is the time to note the places where the trees have failed to produce the best results from this cause, so that these mistakes may be avoided in future planting. On the other hand, where woods have been a complete success

it is equally desirable that permanent records should be kept concerning them, such as age when cut, species, pure or in mixture, height, cubic contents, etc. Such information is of the greatest value for the future management of the new crops and for the purpose of forestry in general.

"To pass on now to another subject, namely, replanting, I feel convinced that in devoting some time to a discussion of this important question a very useful purpose will be served. I therefore venture to make the following suggestions:—Wherever replanting is to take place a well thought-out but simple planting scheme should be prepared. The object being that the planting should be carried out in such a way, that it would fall naturally into line with a future working-plan. In only too many cases in the past plantations have been formed in a too haphazard manner. We should try to avoid having bits of young plantations surrounded or mixed up with portions of old woods, which must inevitably disappear within a few years, leaving the young trees prematurely and unduly exposed to wind and storms.

"I would like to go further than this and to see a simple working-plan prepared for the future management of the woods on every estate, and even a common or mutual working-plan for two or more estates, where the march lines may divide into several portions an area which should otherwise be uniformly treated as a definite planting unit.

"We may now pass on to consider some points regarding the precautions necessary in the choice of species according to soil and climate.

"The selection of the most suitable species according to the concrete conditions of the area is of vital importance, and is at the same time a very difficult question to answer off-hand. Certain fundamental facts have to be noted, such as the growth and condition of the trees on or near the area in question and the nature of the flora. Elevation, aspect, and shelter are also determining factors, while the soil, though important, is not necessarily the final deciding factor. The choice of species, therefore, involves a special or critical survey as distinct from a flying survey. This means a considerable amount of detailed study of the area, and as yet few areas have been critically examined. Under the circumstances, therefore, we should, as far as possible, stick to our best-known trees, *i.e.* the commoner

conifers or hardwoods, as the case may be. When in doubt as to the hardiness of a species, rather choose the next hardier species, though of less value, than run risks of failure.

"The provision of suitable shelter is a most important factor in the life of a plantation, especially in the earlier period of its existence. Still, in spite of this, one may frequently note cases where plantations have been formed and no provision made for their protection, in the shape of shelter-belts. In this country, although woods run more risk from wind than those on the Continent, we find much less attention is paid to the provision of wind-breaks and shelter-margins. The new plantations which must be formed to replace the old woods now being felled will, of a certainty, have less shelter than those formed before this unprecedented clearance of wide areas. This consideration would seem to justify the anticipation that we will have to pay more attention to the provision of shelter for those new plantations. Having formed our new plantations we must consider their protection from other dangers such as rabbits, squirrels, game of kinds, fungus and insect pests.

"It is to be feared that the general cutting of large areas which is proceeding at present will result in an epidemic of insect pests, and it does not require a soothsayer to predict that the pine weevil, and possibly the pine beetle, will not be the least harmful of these. Fortunately it is not beyond the power of man to cope successfully with such pests, provided scientific methods are employed, and, what is of equal importance, that these methods are systematically applied not only in individual cases, but collectively over a wide area.

"The same precautionary and exterminative measures are applicable in the case of fungi. The squirrel pest must be met in the same way. Game of kinds and rabbits must also fall into the category of forest enemies. Game, if kept within reasonable limits, need not offer any serious menace to the well-being of the forest, but rabbits must be regarded as forest vermin. They have been permitted to overrun our woodlands in the past, much to their injury, undoubtedly more than most people realise or care to estimate. In addition to this direct injury, rabbits have been responsible for an enormous and otherwise unnecessary expenditure in the formation of plantations, by necessitating costly fencing and netting. I need not enlarge upon this subject, but I leave it to members to suggest

some adequate method of mitigating or eradicating this woodland scourge.

"To come now to other questions closely related to the regeneration and formation of plantations, it would, I am sure, be worth our while to consider and discuss the question of the supply and origin of seed.

"There has been a marked falling-off in the supply of seed from certain parts of the Continent during the last two years, and, apart from the case of exotics which do not produce seed abundantly in this country (Tyrolese larch, *Abies pectinata*, Austrian and Corsican pine), this may turn out to be an advantage if it results in our relying more on our home supplies. Fortunately the home production of seed is ample, in the case of the commoner species, to meet our requirements fully, but we must pay more attention to collecting and extracting our harvests of home seed than has been done in the past. We practically allow home seed to go to waste (with some isolated exceptions), and, while doing so, we pay for imported foreign seed; but this, though a reason, and it may be a small one, for developing a home seed industry, is by no means the principal one. The importance of cultivating only trees of a good strain, race, and type is enormous. Botanists, and here I refer to the systematist, recognise species and varieties, but no matter how minute the distinction or division may be from the systematist's point of view, there exist, undoubtedly, physiological strains or races among individuals which are only recognised by the cultivator. I feel tempted to go further into this fascinating and important question, but that would lead away from the immediate object in view. All good foresters know that in the case of the Scots pine, for example, there are many types to be found in various parts of Europe, and by long continued importation of seed and seedlings we have, in this country, a very heterogenous collection of types of the species, good, bad, and absolutely worthless. I need only recall the demonstration given to members of our Society, on the occasion of their visit to the Experimental Forest Garden at Zurich in 1913, which showed the enormous difference in the growth of larch raised from seed from various parts of Switzerland and other parts of the Continent. (Incidentally, those who saw the trees will recall that the plants from Scottish seed were easily first.)

"So much for the argument then, if such is necessary, in favour of home seed collection. Our home trees are of a race and type second to none in all the desirable silvicultural and timber producing qualities of their species. Why, then, should we allow so much of the seed of these trees to run to waste, while we buy and pay for seed less likely to give satisfactory results in our climate? This, gentlemen, is, I think, a subject worth discussing.

"While on a subject connected with the nursery, and in reference to our future pit-wood supplies, and harking back to a discussion which took place last year, namely, the planting of rapid-growing species with the object of securing an adequate home supply of pit-wood in the least possible time, I think some of the members might give us their views as to the nursery treatment which these species should receive—such as the best age of plant to use and the number of times transplanted, if transplanted at all.

"Next, as regards the areas which should be first taken in hand for replanting, I suggest, for the sake of discussion, that those areas most accessible to the industrial or consuming centre should be planted first, then those areas conveniently situated for timber transport by rail, leaving the more remote areas to be developed later. No doubt as those last areas develop, road and rail transport will improve.

"To pass rapidly on to another topic for discussion, we might consider the future silvicultural practice best suited to yield the kind of material which experience has shown us is most essential, especially for the needs of the country during a crisis like the present. If, and I think the 'if' is unnecessary, the future market for home pit-wood remains good, then a question for consideration will be the density of planting. Hitherto early thinnings have not been of much account, and consequently the planting has been kept as wide as possible to save initial expense in plants and labour, and to avoid extra labour and expense in early thinnings; but with the prospect of a better market in future for such material, possibly somewhat closer planting might be justified.

"I need not refer to the importance of planting in large blocks, as this subject has already been fully discussed and decided.

"I have suggested subjects for discussion by the forester,

nurseryman, and the scientist, and now a word for the timber merchant. I am sure it would be of great value to have their views on the possibility and desirability of more attention being paid to the grading of timber into its various qualities and dimensions, suitable for the needs of the various classes of wood consumers ; and also in how far the methods of seasoning timber might be improved.

"Last of all, what can be done to encourage all kinds of wood-consuming and manufacturing industries, large and small? (cellulose, charcoal distillation, turnery, osier growing and manufacture, hazel rods, and tanning material, bobbins, etc., herring barrel and box manufacture, and boat building). We have the machinery and the skilled workers in many wood-consuming industries producing all our home requirements at present, and the more raw material we can produce for their use now and in future, the greater is the likelihood of their becoming firmly established and flourishing as well as increasing in magnitude and number.

"One word of caution before closing. I would like to point out that the present quality of pit-wood which is being supplied to the mines, though quite suitable for their purpose, must not be taken as a criterion of the quality of pit-wood this country is capable of producing.

"A sudden unprecedented and unanticipated demand for timber trees of all sizes and classes has been made upon the resources of our home woods, and some of the timber which reaches the mines comes from woods which have been entirely neglected, because the prices previously offered for home supplies would not justify any expense being incurred in their improvement, and even in the case of the material of better quality, it is rushed to the mines, unbarked and undried, to meet the immediate requirements, and this places the home product in an unfair light when compared with what we were accustomed to import before the war. Probably the fault is partially due to the consumer, who had previously done little to encourage home production by offering prices which compared very unfavourably with these paid for imported material. I think you will agree with me that this remark applies equally well to all classes and kinds of home-grown timber.

"The price of home timber has, generally speaking, been relatively too low as compared with the price of imported timber.

This is perhaps due to several causes—such as the uncertainty of large and constant supplies, lack of co-ordination among both sellers and buyers, and the almost entire absence of any attempt to grade and season home-grown material.

"We have forest land in abundance. We have trained foresters who are capable of making the best use of that land, and our timber merchants have recently shown what they can do in the way of conversion. Afforestation, therefore, on a large scale, combined with approved silvicultural methods, and attention to grading, classification and seasoning, cannot fail to establish on a firm and permanent basis the undoubted merits of home-grown timber and ensure an adequate supply for all time."

The Chairman said:—"Dr. Borthwick has given us a comprehensive and interesting survey of the problem. As he has touched a great number of topics there must be a number of members who have views on these topics, and I hope they will take a part in the discussion. I join with Dr Borthwick in appealing to the timber merchants here to take a part in the discussion and help us by expressing their views on the subject."

"Mr J. H. Milne Home said:—"I have not come here expecting to take part in this discussion, but I will try to refer to a few of the points mentioned. Dr Borthwick confined himself a good deal to questions of replanting existing areas, and I have no doubt he did so for good reasons, because, after all, it is almost more important to get these large areas replanted, and replanted properly, than to take in new ground, but this implies that the replanting will be done by the proprietors, and not by the State, although there might be cases of State assistance. I think a point which should be kept in view is, that the only practical work and the most efficient work that has hitherto been done has been done by private owners, and it must be admitted that they at present have the skilled men and the skilled staffs to do the best work in planting, whether on old ground or new, and are in the position to do it most economically. My own feeling, therefore, is that planting by existing owners who have their records and have the skilled staff and know a great deal more about it than any one else does at the present time, is likely to be most successful and most economical in the future, and that such

planting should be encouraged in every sort of way. The question of costs, even if prices of timber are going to be better in the future, which we feel sure they will be, is the main consideration, the first cost especially, because it is cumulative at compound interest. There is no doubt that on large estates planting is done more cheaply and more efficiently than there is any possibility of it being done under a new State scheme involving fresh ground. At present there is a very heavy burden of taxation on woodlands. The valuation of woodlands in many cases has been reduced, but the taxation on that valuation is exceedingly high. The present income tax is 5s., and the owners of many large estates have to pay super-tax of 3s. 6d. as well, not only as owner, but as occupier. At the present moment any one who has to pay 5s. income tax and 3s. 6d. super-tax is paying about 16s. in the £ on the valuation in income tax and super-tax alone, and if you add to that the owner's and occupier's county and parish rates, and a proportionate share of minister's stipend in the heritors' assessment, and the land tax, I could produce to you actual figures showing that by adding all these burdens together, some owners are paying something like 21s., 22s., or 23s. in the £ on the valuation of existing woodlands. Now, even if your valuation is very low, even supposing it is 1s. per acre, that means that that ground under sheep would be worth 1s. per acre, and if you let it for that purpose you merely pay owner's rates and taxes. If you plant it you more than double at once the burden of rates and taxes, quite apart from the outlay which you expend upon it. I think that is a point, as it affects the larger estates particularly (and the largest must be the ones that you must look at), that does call for some remedy.

"I do not think any owners of land, large or small, ask to escape their proper share of the burden of taxation, but I do not think any one will say that 20s. per £ and over is a fair or reasonable share of taxation if these individuals are to be expected to plant, and to plant extensively. By a section of last year's Finance Act, any one who replants after July last can claim that the replanted area is a separate estate for the purpose of income tax. Such plantations escape all taxation or income tax until they are producing a profit. When they do produce profit they require

to be assessed under Schedule D, and they pay on the profits. That, of course, is a very minute concession to begin with, because if you happen to have five thousand acres of wood, and you replant eighty or a hundred acres in a year, it is only a very minute portion of the income tax assessed on your woods, but it will grow, and I think it is a thing that, apart from the saving in money, which is very small, everybody should take up and claim as a matter of principle, if they consider it beneficial to do so.

"Dr Borthwick referred to the question of rabbits. I think public opinion is educated up to the point that if you want to keep rabbits you ought to fence them in, and not let them go on other people's property. The great difficulty is in getting legislation. It is very difficult to see how that legislation should be framed. Within recent weeks the snowstorm was very bad in the South of Scotland, and I took the trouble to go over a good many acres of young plantations, some of them 2 or 3 or 4 feet high. There was 1 foot or 18 inches of snow, and not in the whole of these plantations was I able to discover a single plant eaten by a rabbit, and there was not one yard of wire-netting round them. Had there been any rabbits the damage would have been very serious.

"I hope there will be some expression of opinion on the subject of young plants. My own belief is that three years is old enough to use many plants. Four-year-old plants are too big. For the Japanese larch, I think that 1-year 2-year plants are better—better rooted, more bushy, and they go away faster after they are planted. The distance between plants seems to me very important, but there again the question of initial cost comes in. Plants, to my mind, are quite close enough at 4 feet, and 4 feet is, theoretically, 2750 to the acre, but you may count it 3000. With certain species some authorities give 5 feet, but to my mind 4 to 5 feet is a good planting distance for any of the plants that we have to deal with.

"Dr Borthwick also referred to wood-consuming industries. My opinion is that we have been very much behind other countries in that respect in the minor industries. There is no doubt, I think, that a good deal could be done in connection with charcoal and wood distilling with small modern plants. There may not in a lot of these things be very much actual profit, that is to say, you may sell £400 or £500 worth

produced from your plant, and you may not make more than £50 profit on that. The way I look at it is that £300 or £400 has been spent on labour, and you are employing labour in the country districts. Even if you have only a small profit, if it is a reasonable profit, it seems to me that it is our duty to encourage that class of industry in order to establish the labour where we want to see it established."

The Chairman said:—"On the subject of taxation Mr Galloway has received a letter from Colonel Malcolm of Poltalloch, which seems to come in rather appropriately at the present time."

Mr Tom B. Jones, Timber Merchant, Larbert, said:—"As Dr Borthwick has appealed to timber merchants particularly, I shall endeavour to respond. As a Scottish home timber merchant, I should like to make a few statements which experience and time will, I think, duly verify:—(1) That home-grown Scots pine and spruce pit-wood for mines, if selected and seasoned, is equal to foreign pit-wood; (2) that battens cut from selected Scots pine and spruce are equal, and often superior, to foreign redwood and whitewood; (3) that selected larch is suitable for practically every purpose where pitch pine is specified, and at the same time possesses two great advantages, viz. greater strength and durability; (4) that for such purposes as those of ship-builders, railways, mines, etc., with some exceptions, selected British hardwoods are equal, and in many cases superior, to foreign hardwoods; and (5) that for furniture and panelling purposes there is more variety of character in the 'figure,' and therefore greater beauty in British hardwoods than there is in foreign hardwoods. I do not think the general public fully realise the value of vast woodlands to the nation. Irrespective of planting and cultivation there will probably be spent per acre in wages alone, before a good average timber crop is cut down, sawn up, and delivered in the home market, about £50 per acre, or, in the case of a million acres, £50,000,000 sterling; and assuming a rotation cut you get, fifty years hence, per each million acres, steady and healthy employment for about 10,000 woodmen, representing, with their families, probably 50,000 people.

"Perhaps the following suggestions may be found worthy of consideration:—The replanting of natural woodlands of not less than 10 acres in extent to be compulsory upon owners

within seven years of a clean cut, given suitable soil and altitude. If replanting is not done by the owners of land within seven years, the State to replant at its own expense. Owners of land to have the option, twenty years after the planting is done, of repaying the State the cost of planting. If the option is not exercised by the owners within twenty years, the planted area, on payment to the owners of a sum calculated upon the original annual value, ascertained by mutual agreement previous to planting, to become the absolute property of the State. The promiscuous collecting of seed to cease—seed only to be secured from estates within the United Kingdom known to produce the best of a particular species. Private as well as State enterprise to be encouraged by advancing money for planting purposes at actual cost to the State. Owners to be required to invest during the war the sum of £45 per acre, for every acre clean cut out, in the 5 per cent. War Loan; said stock to be earmarked for replanting purposes, and to be made repayable when planting has been done. Government departments and architects throughout the country, in making out specifications, to provide for home timber being used as a substitute for foreign timber, and in certain particular cases to specify only home timber. Such forestry legislation, as indicated, I am sure would be welcomed by the best proprietors. One of the most important matters to decide is the question of what represents the best trees to plant from the commercial aspect of the question and in accordance with locality and soil. Larch is one of the finest woods in the world. I have also great faith in the Douglas pine as a forest asset, both as a furniture wood when matured, and for mining purposes in its earlier stage. In regard to the pit-wood question, there is no doubt that every acre of poor hill-land should be planted up with suitable trees. Home pit-wood will never again be summarily dismissed by the home consumer, and, consequently, there is a great future before it. It is hoped, indeed, that in the days to come consumers will give home pit-wood the preference over foreign pit-wood. The growing of pit-wood as a commercial proposition ought to prove a financial success.

"I was very glad to hear Dr Borthwick suggest that localities near to consumers should be first considered. One has only to consider the Ochil Hills, situated beside a mine-field, with thousands of acres which would grow beautiful larch, at present

producing little or practically nothing. I am of opinion, and I know I am on very delicate ground here, that if it be found necessary in the future to impose an import tax on foreign timber to encourage the production of home timber, there should be no hesitation in imposing such a tax. Dr Borthwick mentioned that he was not quite sure how it was that the plants grown from Scottish seed turned out better than those of the same species grown elsewhere. Well, I think I may say, that as far as my experience goes, Scotland is particularly well adapted for the growing of timber. Its climate is said to be responsible for the hardiness of its people. That same climate is undoubtedly responsible for our plane tree, larch, Scots fir and beech, being better in quality than the same trees grown in England or Ireland. I think Dr Borthwick asked if our own timber could not be classified better. It certainly could, a great deal better. Our home timber, however, has not been demanded, and when you demand a thing you will get a supply. Demand the home timber and you will get it. You will get selected Scots fir, selected larch, and everything suitable for every need of this country. In conclusion, I would say that we should so shape our policy here that Government and private enterprise can go hand in hand. Both will be needed ere the reproach of the nation is wiped away of possessing hundreds of thousands of acres of magnificent woodlands now yielding little or nothing to the great wealth-developing rays of the sun."

Mr H. M. Cadell, of Grange, said :—"In view of the necessity of getting the best sort of trees, it seems to me that nurserymen ought to consider what are the best, and have a supply ready to plant after the war. My experience is that there is no tree like Sitka spruce. Last year many of my Sitkas made a growth of 3 to $4\frac{1}{2}$ feet. There is no conifer that can come near that, not even Japanese larch, and further, the rabbits do not like it, which is an advantage in many places. It grows in the most exposed situations, and is never upset by the wind. It is an extraordinarily strong, straight-growing tree on suitable soil, and, I believe, no tree that has been introduced into this country is anywhere near it in rapidity of growth and durability. To see Sitka spruce growing on cold clay soil at a height of 600 feet above the sea, and adding 3 feet every year, is most extraordinary. It needs a moist clay soil and will not grow well on a

dry sandy soil. There is a great deal of talk about the Douglas pine, but in West Lothian it does not thrive at all. It may do in Perthshire, but it will not do here. The black Italian poplar is another tree that gives a large quantity of wood in a short time. We want to get large quantities of wood for pulping after the war, and, of course, poplars do not produce wood of a very good quality, but they are perfectly good for pulp. In this country we are very wasteful in many ways. We cut down trees and never use the roots. When I was a student in Germany, I took a great interest in the way they cut the trees in the Harz Mountains. They cleared the ground completely and tore up the roots and sold them as cordwood to the people in the neighbourhood for fuel. By and by if coal gets dear in price, which it very likely will, we ought to utilise the roots in this country and not leave them to rot. If there is no local demand for firewood it might well be used for distillation, and tar can be made out of it. There is a great deal of ground in West Lothian that should be used for growing wood on—the immense spent shale bings round the oil works, and on bings at abandoned oil works. The proprietors, if they were sensible men, would have these waste bings planted up, but many of them are very far from sensible—they are extremely stupid and very ignorant of the elements of afforestation. They care nothing about it, and the sooner they are told about it the better. These shale bings on the various estates are an eyesore, and a great waste of good land that is continually growing worse. Most of them are enormous flat-topped artificial mountains, shaped like Table Mountain at Cape Town, and they might be covered with various kinds of trees that would grow there. Some have been standing there for thirty years growing nothing but what grows naturally. If a little seed had been sown on the top of the older bings some years ago it would now be growing, and these bings might be developing into a forest-clad range of mountains by this time."

Mr Robert Allan said:—"I suggest to Mr Cadell that he should come to Mr Robertson-Durham's estate and see the top of a bing planted there, and he will see the success of it."

Mr Cadell.—"If Mr Allan would come to other parts of West Lothian he would get more benefit."

The Chairman (to Mr Allan).—"Have you any experience?"

Mr Allan.—"Mr Robertson-Durham did it, and it was quite

a failure. It depends on the nature of the fire-clay. The bings will do if you prepare them, but not on oil works' refuse unprepared."

Mr Milne Home.—"My experience is that almost any kind of bing, if it is fairly fresh, will grow grey alder or white alder."

Mr James Whitton.—"The ordinary pit bings, where you get a mixture of shales and stones, will grow trees, more especially alder. Mr Whitelaw, of Gartshore, obtained the most successful results I have seen, but what can you do with oil shale? I have not even seen a weed growing. There have been bings at Nitshill for forty or fifty years, and there is not a blade of grass growing there."

Mr Cadell.—"There are some sorts of shale which contain iron pyrites, and when sulphuric acid is formed by the decomposition of the pyrites it kills all vegetation, but there are others quite free from this in which plants will grow."

Mr Whitton.—"The ordinary mixture of a coal-pit bing will grow a lot of things, but the pure shale will not."

Mr Cadell.—"Some of the pure spent oil shale grows things perfectly well, and natural brushwood is appearing with rough grass and herbage on the abandoned bings near Linlithgow."

Mr George Leven said:—"We, fortunately, have been in the position in this country of being able to supply a certain amount of timber, and the question now, I think, is more what we are going to do in the way of re-afforestation. It is not altogether a question of what we are to plant. In the first place, and, I think, it is a matter that we ought to consider seriously and place before the nurserymen, there is the collection of seeds and to see what seeds are to be collected first. If the plants that you want are not in the country, what are you going to do? It takes three or four years before plants can be planted out, as we have seen, and, I think, therefore, that we ought to begin to consider from the initial stages what is really required. Dr Borthwick said he did not doubt home pit-wood had come to stay. I firmly believe that is the case, and if it is, it behoves us to go about our business in a quite different way from what we would do if we were meaning to produce only timber of large scantlings. We must prepare the way with the best growing species.

"Probably we will hear to-day, as we have had in the newspapers recently, an advocacy of spruce-planting. That in

many parts of our country, fortunately, is quite a reasonable propaganda, but, taking our country as a whole, I think it is a gross mistake to go in for the planting of spruce wholesale, or even to a large extent. Take the eastern part of Scotland, as defined by a line drawn somewhere through the centre, from north and south, and you will find that the rainfall in the growing months of the year is of such a nature that the growth of spruce is absolutely out of the question in these areas. At a very early age, to the east of that line, the tree begins to die off. It is not only attacked by the disease popularly called spruce needle-rust, but it begins to decay very early in the roots, and this rust and the decay I attribute to the want of rainfall in the growing months. If that is so it behoves us to put in something that will withstand the dry seasons and will give a very speedy return. Poplar is very useful for paper pulp, but I do not know if it is so suitable for pit-wood. Colliery managers, I think, have an objection to it unless in the root cuts. Further up in the branch the wood will not stand the strain.

"Sitka spruce demands even greater rainfall than the common spruce, and Sitka is a plant that does very well on an acid soil, and will stand a great amount of moisture, but it requires a soil altogether different from a dry soil. The Douglas is a very fast-growing tree, no doubt, but there are a great many districts in which it will not grow. It requires a great rainfall too. Nothing comes near the Japanese larch, one of the fastest-growing trees that we have introduced into our country. I could point to Japanese larch that is quite suitable for pit-wood at sixteen to twenty-two years of age. The trees are able to withstand an enormous amount of overshadowing with their own species, and are therefore able to stand very thickly, and the return per acre is equal to, if not superior, to anything that can be produced for pit-wood. I am not advocating the Japanese larch where European larch will grow, because my experience is that if you find European doing extremely well, as for instance in the Stewartry, I would never attempt to put in Japanese to take its place. Go to Argyllshire and you find European larch luxuriant there, but there are many places in Scotland that could be planted with Japanese where European would be entirely useless through disease. The production of hardwoods does not call for immediate attention. We have, fortunately, still excellent supplies of hardwood in this country, and, I think,

it is more coniferous timber that we will have to look to and produce. As regards coniferous timber the demand at the moment has been for Scots pine, but although that is so it is not to say we are to plant only Scots pine in the future. At the same time we see, as has been already pointed out, that we are on the right way as regards hardwoods, and we must try to judge as to what is to be the immediate necessity in the way of coniferous timbers. Corsican pine is very well adapted for sandy soils, and on some arid and dry soils I think it surpasses the Scots pine as a drought resister, and it is eminently suited for a great many dry situations. White American spruce, *Picea alba*, is excellent for exposed situations, and for shelter-belts and the margins of plantations. It is a very fine tree, and one that gives a remarkably good return in pit-wood at a very early age. Banks pine is planted rather sparingly, and we do not know a very great deal about it. It has been tried in Germany and other places on the Continent, and it is most remarkable how it can adapt itself to the very poorest soils. Also it is absolutely frost-hardy. Unless we can produce these things quickly the game is lost. We want to get them and get them in such quantities that they can be available the moment they are required."

Mr Adam Spiers, Timber Merchant, said :—"Dr Borthwick's address is the most lucid and concise that has been put before this Society in my time, because, I think, he has taken a grasp of every item that is necessary to go on with successful afforestation. The great objection that I have is that we have waited far too long at the beginning, and evidently we are still at the beginning. I think all the scientific and practical minded men in this room know perfectly well what trees we should plant in Scotland. He is a very short-sighted individual who moves through this country and cannot see the enormous possibilities of our country for the production of timber, and I was glad to hear Dr Borthwick say that we in this country can produce a larger variety of timber than any other. With that I quite agree. More than that, I think there is no country produces such a variety of timber and of such a quality as Scotland does. Take our British oak. There is not a waggon-builder, or a man who needs material of the greatest strength, who would want anything else but British oak. Take our ash. There is no ash comes into this country that can come near it.

Take our sycamore. Substitutes have been tried from all the different countries in the world to take its place for cotton-bleaching work, but nothing gives the same results and the same lasting quality. Last Wednesday I met a bobbin manufacturer who does a fairly large business in the manufacture of bobbins for the Calcutta market, and he told me that they are likely to lose that market because the Japanese can send them in at a much lower cost. I said, 'Now, how do you think that this Japanese bobbin is going to take?' He said, 'As far as I know,'—and he had a son representing the firm in Calcutta—'the Japanese wood is more brittle than our own; the birch is the preferable wood.' Now, every man who has ever gone round the West of Scotland knows that there are, not merely acres but square miles of scrub birch. It is a disgrace to the afforestation of this country that, through lack of a little care, we have not been raising and utilising enormous quantities of birch. Take the birch bobbins required by our great thread works. The bulk of these bobbins come from Norway and Sweden. They should all be produced at home. Take even our beech. There is not a tree in this country that is more beautiful, I daresay, but through want of proper silvicultural treatment, and where it has been grown for its beauty only, you may get a fine short stem about 10 or 15 feet long with about 2 tons in it, then 5 tons of top the removal of which very often costs more than it is worth.

"As to Mr Cadell's reference to the roots, I am very sorry to say that Scottish folk have not sufficiently awakened to the need of thrift. I have burned many tons of brushwood this year. You would need to cart it to the doors of the consumers and put it on their fire before they would use it. What we want is to keep going at our Prime Minister, who evidently takes a great interest in afforestation, and sees the great necessity for planting and planting largely. There are any number of acres in the isolated corners of this country that would grow beautiful hardwood, even beautiful conifers, but they are left barren wastes because, even if they are planted up, before they are 2 feet high, the trees are killed by rabbits. You will never grow trees and rabbits together. The question is whether rabbits or trees are better worth preserving. This country could have sustained nearly one-third more, or one-half more, of its population in afforestation than it is doing to-day if we had only gone the right way about it. I think it is a great national asset

being lost to the nation, this hanging back from the planting of forest lands, and if we would only be guided by what Dr Borthwick has said, we should be a long way on the road to successful afforestation."

Mr Charles Robertson said :— "There has been a great deal said about rabbits. Why confine it to rabbits? I find the hares as bad as the rabbits? When the plants get up to 2 feet in height the hares attack them, and then they take the top; they do not go round the bottom like the rabbit."

Mr J. A. Duthie, Nurseryman, said :—"With regard to forest tree seeds, Dr Borthwick put the whole matter very clearly in urging the better utilisation of home-grown supplies, much of which in the past has been wasted. In case his remarks concerning Scots pine should be misunderstood, perhaps I might be allowed to add that, speaking with thirty years' experience of the nursery trade, I have never heard of any Scottish nurserymen importing seed of Scots pine from continental sources. The foreign species is so subject to the leaf-shedding fungus that it is quite impossible to raise a satisfactory crop of transplants. No practical forester would accept the continental type in place of true native. It partakes more of the characteristics of the Corsican pine, and is altogether a very inferior type of Scots pine compared with our native tree. I am not so hopeful as Dr Borthwick in thinking that all the tree seeds (exotics excepted) required in this country can be got at home. This is perfectly true of Scots pine, which is produced so abundantly in this country that there is not only a sufficient supply for all home requirements, but in good seed years a large surplus is usually exported to France, Denmark, and Norway; but our home-grown supply of all other species of conifers must be supplemented from abroad. As regards larch, a great many proprietors will not plant native larch, but stipulate for Tyrolese, and will have no other. As a matter of fact, sufficient native larch seed cannot be got in this country to produce the quantity of larch plants annually required for planting. Limited quantities of Scottish-grown Norway spruce and Douglas fir seeds are occasionally offered, but never in sufficient quantity to keep up the necessary stocks. Home-grown seed of Douglas fir is frequently so full of *Megastigmus* as to be almost worthless.

"The fears expressed three years ago that the outbreak of war

would lead to an acute shortage of tree seeds have happily not been fulfilled. Excellent larch and spruce seed from the French and Swiss Alps have been available, quite as good a type, I believe, as formerly imported from the Tyrol. I have grave doubts in my own mind whether the seed formerly imported from Germany was always secured from the best sources, as regards elevation, age, and quality and type of seed-bearing trees. For seed of our two most valuable exotic conifers, Sitka spruce and Douglas fir, we must look for many a long day to the western states of North America. With regard to hardwoods — ash, beech, sycamore, and oak—the necessity of importing these from abroad should not often arise. Considerable quantities of seeds of these are collected in Scotland, but it is a pity that supplies could not be drawn from some of the fine stands of hardwoods located in the South of England. For sowing this season there is no shortage of tree seeds, except beech, the crop of which is a failure all over Europe. I fear that the present demand for plants, combined with the shortage of labour, scarcely warrants nurserymen making extensive sowings; but if a shortage of plants should arise, do not blame the nurseryman. Create a healthy demand for forest trees, and I am perfectly certain that British nurserymen will provide a supply.

"I am glad that Dr Borthwick emphasised the necessity of developing our native tree seed industry, and it is capable of extensive development, not only in finding a use for large quantities of seed, the collecting of which would provide a great deal of employment in forest areas, but in locating the best areas from which seed ought to be collected. Nurserymen are often blamed, and, I believe, without cause, as to the sources from which some of our native seeds are collected; but the only sources of supply in this country are private woodlands. I have often urged that all seed-bearing areas be scheduled, and the seed collected under expert supervision. The seed of a crop which requires eighty to a hundred years to come to maturity warrants every care being taken in securing the best. The North of Scotland is the only district in the United Kingdom where the business of seed-collecting has been a recognised industry for many years; and when re-afforestation really comes, seed-collecting ought to become one of our most important rural industries. To show what can be done in strictly woodland areas, one estate in the North has already

sent me 300 bushels of Scots fir cones, and I expect to receive other 300 bushels, all of which have been and will be collected by the wives and children of the estate workmen."

Mr Whitton said:—"Is the selection of the trees not a very material matter? I am satisfied there is too much attention paid by collectors not to the selection of the best type but to the trees that give the most cones."

Dr Borthwick said:—"I think it is highly desirable that seed should be collected from trees of a good type. The effect on the seedling is enormous."

The Chairman said:—"We have had a very practical discussion, and it has been very practical because it was introduced in such a practical way by Dr Borthwick. We thank him very much for the way in which it was done. There is one subject he alluded to, although it is more a national subject—the survey that will have to be made. It is a subject that our Society has always been very anxious about. For years and years we have pressed on the Government the necessity of a survey before they undertook afforestation on a large scale, and I may say, I am sure, on behalf of the members of the Society, that the Government may command our services in the matter. If they wish a survey carried out, we shall be very happy to do everything in the power of the Society to further the object in every way the Government may think desirable."

18. Organisation and Activities of the Chinese Forest Service.

By Forsythe Sherfesee, Adviser in Forestry.

Almost simultaneously with the establishment of the republic, there became manifest a growing recognition of the importance of forestry, of the severe loss along many lines from which China has suffered and must continue to suffer, due to the wholesale deforestation which took place centuries ago, and of the need for taking active steps to remedy the situation. The first result was shown when Mr Chang Chien was Minister of Agriculture and Commerce, for under his administration certain progressive forest laws were promulgated. Nevertheless, it is proper to consider that forestry in China, as an aggressive national activity, and in the sense in which the word is under-

stood in Western countries, had its first real beginning with the inauguration, in January 1916, of the Chinese Forest Service in the Ministry of Agriculture and Commerce. Mr Chow-Tzu-chi, recently Minister of Agriculture and Commerce, must be given principal credit for taking a step which, unless unforeseen contingencies intervene, or unless future obstacles are placed in the way, cannot fail to have an extraordinarily wide and permanent effect upon the welfare of the Chinese people from very many points of view. It was due to his foresight, patriotism, and frank recognition of what was necessary to meet an admitted economic need that the Forest Service owes its existence. As Minister of Agriculture and Commerce, he submitted, on 22nd December 1915, a memorial to the President, requesting authorisation to organise a "National Forest Service" in the Ministry; and a favourable reply was promulgated on 3rd January 1916. The Forest Service thus created was entrusted with the supervision or execution of all Governmental work in forestry, and with the encouragement of private enterprise along similar lines. At the head of the Service is the Minister of Agriculture and Commerce. The Vice-Minister is *ex-officio* director-general. The Adviser in Forestry also acts as one of the two co-directors, the other being a Chinese (Mr Ngan Han), who had obtained technical education in forestry in the United States. There are several other technically trained Chinese in the Service as well as an English forest expert (Mr William Purdom), who serves as the chief of one of the six divisions into which the Service is organised.

General Policy.

The general policy which the Forest Service has adopted may be expressed as follows:—

1. To lessen the present scarcity and high price of timber, fuel, and other forest products of all kinds by the judicious reforestation of public lands unfit for agriculture and now lying wholly or partially idle, thereby lessening the industrial handicap under which the Chinese manufacturer, farmer, and householder labour at present, and increasing the comfort and raising the standard of living among all classes, particularly the middle class and the poor.

2. To regulate stream-flow by the reforestation of the more

important river-sheds, thus tending to prevent floods, droughts, and the silting-up of river bottoms, with a consequent obstruction to navigation, and the frequent bursting of dykes, the construction of which, in the first place, was caused largely, if not wholly, by the deposits of silt washed down from the deforested slopes.

3. To protect by technical forestry management, involving wise use, such public forest resources as still exist.

4. To encourage similar activities by private parties by demonstrating that forestry in China is an attractive financial investment, and by supplying needed advice and practical assistance.

5. To conduct a vigorous pro-forestry propaganda throughout China, showing to all classes of people the present national need for forestry, what deforestation and reforestation mean individually to the people, and the steps which the Government is taking and proposes to take to better the situation.

6. To train up a corps of young Chinese to carry on the various lines of forestry work in China, and to encourage and, if possible, to assist in the giving of similar instruction in the educational institutions already established.

Although the general control of the activities of the Forest Service was immediately centred in the office of the director-general, working under the approval of the Minister and through the two co-directors, a further and more specialised organisation into divisions soon became urgently called for, in order to ensure that all the various activities which the Forest Service must or should perform would be carried out with the highest possible degree of efficiency, economy, and harmony. It is evident, of course, that without such a clearly-defined segregation of duties or responsibilities, there must inevitably be more or less duplication of work and loss of efficiency, and, what is equally important, the Service would fail to secure the benefits which result from training its new personnel to become real experts in the particular branch of forestry for which, by inclination and ability, they are best fitted. Thus, in February 1916, the Minister approved the creation of six divisions, namely, the Divisions of Investigation, of Reforestation, of Propaganda, of Education, the Provincial Division, and the Clerical Division. It is also planned to appoint a forest commissioner in each province who, with a staff of assistants, will encourage

and supervise forestry work of all kinds within his respective jurisdiction. Each of these divisions will be taken up separately.

Division of Investigation.

The work of this division must lie at the very base of all sound and effective forest work in China. Without the sound, reliable data which may be expected to result from its activities, individual projects would have to be decided upon and carried out in a more or less haphazard, experimental manner. It must be kept constantly in mind that forestry in China is distinctly new, and that although along general lines it is reasonable to suppose that the methods which have been found most suitable in other and rather similar countries can be applied here, nevertheless the peculiar conditions of soil, climate, and especially what we may call the sociological conditions, make it absolutely necessary that any methods imported from abroad should undergo more or less radical adaptation before success can be expected in China; and in many cases, even at first, it will probably be necessary for us to work along original lines. Thus, before we can be in a position to take up with confidence, and to carry on successfully, economically, and efficiently any extensive scheme of reforestation, we must have a fairly solid ground-work, based on a sure and reasonably complete knowledge of the climate, soil, and other conditions under which we propose to work; of the species of trees, both native and foreign, which are suitable for use in the particular areas under consideration; of their silvicultural characteristics, rate of growth, economic importance, etc.; of where their seeds can be obtained; of what has been learned from former experience of their use in China; and many more points along similar lines. In these studies particular attention will be given to the native species, both because in general less is known about them, and because, in all probability, they are best suited for our use, due to their proved adaptability to the conditions under which we will have to work, and to the comparative cheapness and ease with which their seed can be obtained. Very probably much of the needed data has already been collected by various persons—private botanists, travellers, missionaries, teachers in various colleges throughout China, members of this or other bureaux or ministries, etc.; but the results of all such studies are more or

less useless for our purpose until they have been collected and correlated, and so made available. Obviously, also, such information is necessary before we can be in a proper position to train new personnel.

It was to accomplish these duties that the Division of Investigation was organised. It has proceeded actively with its work, and already a considerable amount of most useful data has been made available.

Reforestation Division.

This, at present, is the executive branch of the Forest Service responsible for the economical and successful carrying out of all reforestation projects, including the establishment and care of nurseries, collection of seeds in large quantities, shipment of seeds and plants, transplanting to permanent locations in the hills, etc. It is the work of this division which will attract most public attention, and in many ways it is the climax of all of the other activities of the Forest Service, at least until it becomes possible to place existing forests under technical forest management. This will be referred to later on in this article. For the present, at least, all the other divisions will be indirectly but largely engaged in helping to make it possible for the Reforestation Division to do its work on a large scale, successfully and economically. The success of the Forest Service will, as it should, be judged largely by the success of this division, and, therefore, too much care cannot be spent in supplying it with a scientifically sound ground-work (the work of the Division of Investigation), and in assigning to it the best possible personnel wherever such personnel can be secured. It would be a fatal mistake to regard each reforestation project as distinct and separate in itself. They must be all grouped in one division under a single chief, who, under the director-general of the Forest Service and the two co-directors, will be responsible for the success or failure of them all. Otherwise unnecessary and undesirable duplication of experimental work will be sure to result—the same failures will continue to be made in each project, and what is learned in one place will not readily be available for other projects. Only thus will we be enabled to make the widest and most practicable use of the knowledge we gain from our failures and our successes. Moreover, by having all such projects directly under the constant supervision of a

single chief of division, it will often be possible to assign to an individual project a man of lower calibre than would otherwise be possible (a very important consideration at this time when trained personnel is so scarce) who, while competent to give satisfactory service under another's supervision, would be unsuitable to take charge of more independent work. As soon as opportunity permits, and the time has not yet come, we will secure, either by direct appointment or by training, men competent to act as "inspecting forest nurserymen," or "supervising forest nurserymen"—men who are thoroughly familiar with all the details of the most modern nursery practice (having gained such familiarity not merely from theory but from actually doing the work themselves). Under the supervision of the division chief they will spend all or most of their time in visiting the various projects, reporting to the central office on the results achieved in each place in proportion to cost, etc.; as well as on the relative ability of the various local personnel; correcting mistakes before they have been carried too far; giving advice for improvement wherever it is possible; keeping the man in charge of each project in touch with what has recently been learned in other projects, etc., etc. Such work and such a corps of men is of fundamental importance; in fact, it is impossible to see how satisfactory results can be accomplished without them, although at the present time such men in the Forest Service are very few, and the difficulties in the way of securing others seem, just at present, so great as to be well-nigh insuperable.

Provincial Division.

This division has supervision over all forestry work carried out by or in the various provinces, except in the case of those projects (such as forest nurseries) directly established and maintained by the Forest Service itself. To the chief of this division there will be referred, through the director-general and the co-directors, all correspondence received from the provincial forest commissioners, and from any provincial forestry bureaux; and he will prepare for the signature of the proper official whatever instructions or suggestions it may be desired to send to the provincial authorities. He is expected to keep himself thoroughly informed at all times of the progress made in forestry in each of the provinces, and he will maintain

a constant correspondence with all provincial forest commissioners, acknowledging and commenting upon their monthly reports, making suggestions, offering criticisms, keeping them informed of the progress made in other provinces, etc. He will know how the forestry funds of each province are being spent, and he will compare such expenditure with the results obtained. When called upon, he will be able to give a reliable, frank opinion in regard to the faithfulness and ability of each provincial forest commissioner, and of his technical assistant or assistants, if any.

The success of the provincial forest commissioner organisation will largely depend upon the chief of this division. If left to themselves, it may be expected that in most cases there will be but little work or only perfunctory work. Without constant prodding and stimulation, the provincial organisations will soon become moribund and the money spent for their upkeep will be largely or wholly wasted. Even if individual forest commissioners are willing to work, they have to be told what to do, not only once, but repeatedly, and slowly and patiently trained to their duties. The best forest commissioners must be shown that their work is known and appreciated; and the poorer ones must be given to understand that the Ministry is not unaware of their failure. It is, of course, desirable that each forest commissioner should have received technical training in forestry, but at present, and for a long time to come, this will be possible of realisation only in a comparatively few cases. The best that we can hope for is to secure a forest commissioner who is actively interested in the promotion of forestry in his province, who appreciates its importance, and who has the influence, energy, and ability to impress such views upon the people at large. We hope to be able to supply most, if not all, such forest commissioners with one or more assistants who have received some technical training. We also plan to maintain a corps of trained assistants to travel from province to province, inspecting and reporting upon the work and attitude of the forest commissioner in each.

In discussing this division I have, of necessity, often used the future tense; for up to the present time its organisation on paper has not been fully translated into actual practice. Obviously, the chiefship of this division demands qualities of a very special type, the possessor of which is very difficult to

obtain ; and for the present, although seriously interfering with his other duties, the work has cheerfully been taken over by the Chinese co-director of the Service. He should, however, be relieved as promptly as possible in order that his full time and energies may be devoted to the broader work implied by his position.

Propaganda Division.

The importance of an active, energetic, intelligent pro-forestry propaganda can hardly be over-estimated. Such a campaign will be conducted with the objects, first, of bringing all classes of people to realise the benefits of a Governmental forest policy not only to the country in general but to each individual in particular ; and, in the second place, to make clearly understood what should be done and the steps which the Government is taking to do it. In this way not only will the Forest Service secure the needed sympathy and support, but the people will appreciate the work which the Central Government is doing for their benefit. The success of such a propaganda will mean that the forestry movement will be a popular one, receiving its support from the great mass of the people rather than remaining, as it is now, a purely official undertaking. Only thus can it be placed upon a firm, permanent basis, or obtain the means for wide expansion. The campaign will be directed towards all classes—the high official class no less than the small merchant class or the peasant farmer ; in fact, rather more so, for, just as in the United States fifteen years ago, the number of even highly cultured and educated citizens who had more than an elementary knowledge of what forestry really is, was decidedly limited, so here in China we must begin at the top, with the educated class and with the officials, as well as in the middle and at the bottom. All classes can be reached. It is merely a question of adopting different media and different methods. Among the most convenient and efficient instruments for use in such a propaganda are—

1. *Newspapers, magazines, and other periodicals.*—The field which these reach is obviously limited, but it is an extremely important one, including the influential officials, the educated classes, and most if not all persons of wide influence and authority. Moreover, it affords the easiest, quickest, and cheapest means of communication. The editors of most newspapers and maga-

zines are glad to publish any article on forestry in any of its branches, which is fairly well thought out and fairly well expressed, and thus we have an opportunity of presenting our facts and our arguments directly to a select and important audience. It is also desirable that the forestry work of the Government should be called *constantly* to the attention of the public, and, therefore, in addition to the longer articles, it is important to see that the daily newspapers receive "personal" items about the members of the Forest Service—such as their arrival from official trips, their departure for work in the provinces, transfers, promotions, new projects, etc.—anything that brings the name of the Forest Service repeatedly before the reader's attention. Our ideal should be that every day the principal newspapers should somewhere contain some reference to the Forest Service, its actual or proposed work or its personnel. Such "advertising," if intelligently conducted in good faith, can be made of very great assistance.

2. *Printed papers, circulars, etc.*—The field which these reach is obviously larger than that covered by newspapers and other periodicals, and they will be used as extensively as monetary considerations permit. As their readers are, generally speaking, the less highly-educated section of the community, the subject-matter will be prepared in a simpler, more popular style. Such circulars will be distributed throughout the various provinces, securely posted at permanent sites where they will attract widest attention, and by all other practicable means called to the attention of the people.

3. *Lectures and informal talks.*—Although newspapers, circulars, etc., are extremely important, and should on no account be neglected, the fact remains that millions of people must be reached verbally, if at all. For these, lectures and informal talks are the only available means, or at least the principal ones.

Whenever possible, the lectures will be illustrated by lantern-slides, or otherwise made more superficially attractive. They will be prepared for the educated classes, for teachers, for students, and for the public in general, as well as for that portion of the public who are illiterate. The schools present a very attractive field for this class of work, and special effort will be made to interest and instruct the teachers in the importance of forestry, in order that they may impart a similar

impression to the students of each succeeding class. Such work can generally be easily arranged, and can be carried on at but slight expense.

We will also take steps to interest all schools—public, private, and missionary—in forestry, and induce them to include something about forestry in their course of study, not with the idea of training up foresters or forest employees of any kind, but merely to impress upon the general student-body what forestry is, what it means to the country, and what the Central Government is doing to foster it. This I regard as very important. If we neglect it we are throwing away an opportunity of great possibilities. We hope that an elementary or primary text-book on forestry may be prepared, popularly written and attractively illustrated, printed at the Government's expense (in large, cheap editions), and sent gratis or at cost price to all the schools. Opportunity will frequently be made for the higher officials of the Forest Service to address the student-bodies of the various universities, learned societies, etc. All these activities are perfectly feasible and practicable, and the resulting benefits are sure, provided that there is an adequate personnel for carrying them on.

Informal talks will be given before the poorer and more ignorant people of the towns and villages by the various travelling members of the Forest Service, by the provincial forest commissioners and their assistants, and by influential men of the locality who may become sufficiently interested in our work. The tea-shops present an excellent location for such talks, or else the local officials can arrange places for larger and more formal meetings. In such talks the audience should be encouraged to ask questions and, in other ways, to take an active interest in what is being said. Such informal meetings, or "talks" (in fact all the methods here mentioned), have proved surprisingly popular and effective in the Philippines, and I see no reason to suppose that they will not meet with proportionate success here.

No matter how strongly and firmly the forest policy may be upheld and enforced by the Central Government (and this applies to other countries as well as to China), it can be made really effective in the highest sense only with the co-operation of the people; without such popular sympathy and support the forester's opportunities for good, however skilful he may

be and however correct his policy, are severely limited—the merest fraction of what they can be made to be under more favourable circumstances. I do not, I hope, underestimate the difficulties; I am convinced that I do not overestimate the importance, especially here, where one of our greatest problems is concerned with protection from fuel gatherers and from theft. Without popular co-operation this difficulty, at least, seems well-nigh unsurmountable. In the Philippines we had much the same situation, although obviously on a very much smaller scale; and there it was necessary to reach the wild tribes of certain mountain regions no less than the civilised Filipinos of the plains; but the desired results were accomplished, and the attitude of the great body of forest users and forest dwellers was changed from active or passive resistance to at least passive acceptance of the new conditions Among the practical and almost immediate effects were a clearly appreciable increase in the collection of just forest dues, a decrease in violations (especially those due to ignorance), and a very notable change for the better in the attitude of the Filipino Assembly. I feel, therefore, that in emphasising the importance and practicability of an active pro-forestry propaganda, I am not indulging in mere hypothesis. The remarkable propaganda undertaken by the United States Forest Service some years ago, and its even more remarkable results, are well known to all foresters.

Division of Education.

The greatest, the most pressing need of the Chinese Forest Service at the present time is an adequate and properly equipped personnel; and as it is obviously impossible to secure the desired number of men who have already been properly trained both technically and in the school of practical experience, our only recourse is to train for ourselves the men we need for the secondary or ranger grades, or at least to have them trained under our supervision in independent educational institutions. It is not a task that can be left wholly or even largely to others. The permanent success of the Forest Service will largely depend upon the training, and especially upon the attitude, which the forestry students acquire during their studies, and hence their education is of so vital importance to the cause of Chinese forestry that it cannot be wholly entrusted to any other body, even if there were an institution able and willing to give

it. There are a few institutions, especially the university of Nanking, making strong and most praiseworthy efforts to train up the kind of men needed for forest work in China, but unfortunately the funds, and especially the staff of instructors, are severely limited.

For the immediate present we are not in a position to concern ourselves with higher technical forestry education. We recognise the importance, or rather the necessity, of maintaining always a moderate-sized corps of highly-trained technical foresters, but it is wholly impracticable to attempt to give such training here and now. In the first place, we neither have nor can obtain the instructors, the buildings, or the equipment; and, in the second place, the cost would be high out of all proportion to the number of graduates. For several years to come it will be necessary to adopt the far more economical course of obtaining the highly-trained foresters we need from among the graduates of forest schools abroad (sending thereto properly prepared young Chinese under Government scholarships) rather than to attempt to educate them here. In time, of course, this situation will change, and we should look forward eventually, I hope soon, towards seeing forestry education given in all its branches in China; but that need not concern us just now.

Clerical Division.

This division, as its name implies, has charge of all clerical work in the central office of the Forest Service—copyists, translators, typists, clerks, labourers, and non-technical personnel of all kinds.

So much for the activities of the six divisions into which the Forest Service has now been organised. Later on, as the personnel of the Service increases, as more funds become available, and when, as a natural consequence, the scope of its activities enlarges, we hope that two other lines of work will attain sufficient importance to justify their recognition in the divisional organisation. Such may be called, tentatively, the proposed Division of Forest Management and the proposed Division of Co-operation.

The Division of Forest Management, if it should be established, will concern itself with the administration, by conservative technical methods of forestry, of existing public

timber lands—not in any way prohibiting their use or unduly restricting the profit which may be obtained therefrom for the present generation of Chinese. We certainly would not wish to create national forest "reserves," in the sense that "reserve" means the locking up of such resources for the benefit of future generations. The forester does not believe in prohibition of use, but in wise conservative utilisation so that the forest resources may be made to yield the greatest possible benefit to the present inhabitants of the country, but without decreasing their productive capacity or their potential benefits to the generations to come. The forester never forgets that the people come first; that forestry is not an end in itself, but a means, although a very essential means, to increasing the welfare of the people at large. This thought is expressed admirably in a book recently issued by Mr Pinchot, former Chief of the United States Forest Service, and the man to whom more than to any other America owes its present forest policy. In the opening paragraph he asks frankly, "What is forestry?" and he answers as follows:—

> "Forestry is the knowledge of the forest. In particular, it is the art of handling the forest so that it will render whatever service is required of it without being impoverished or destroyed. For example, a forest may be handled so as to produce saw logs, telegraph poles, barrel hoops, fire-wood, tan-bark, or turpentine. The main purpose of its treatment may be to prevent the washing of soil, to regulate the flow of streams, to support cattle or sheep, or it may be handled so as to supply a wide range and combination of uses. *Forestry is the art of producing from the forest whatever it can yield for the service of man.*"

While, as I have said above, speaking in general terms forestry in China will be popularly judged by our success or lack of success in reforestation, the management of existing forest areas (which possess a value all the greater by reason of their scarcity) is too important to be neglected, and the Forest Service anxiously longs for the day when such timber lands can be put under technical administration.

The part that the proposed Division of Co-operation will undoubtedly play in the future is very large. As soon as we are in a position to give definite advice as to all important details of reforestation on a large scale (and we in the Forest

Service are the first to recognise that we will not be in such a position until much investigation and experimental work has been done, adapting general theory to the particular conditions of the locality), there is reason to expect that co-operation can be secured from railroad companies, mining companies, universities, corporations, institutions, and private individuals who possess areas of land now lying more or less idle and unproductive. If we can tell them exactly what should be done, what it will cost, and just what results may reasonably be expected ; and if, in addition, we can offer to oversee at least the inauguration of the work and possibly to keep general supervision over it for a term of years, we can in all probability bring about a wide extension of reforestation at little or no cost to the Central Government. The work to be done is too enormous to depend upon the Government alone. The ultimate success of the Forest Service will depend upon its success or failure in inducing private enterprise to take up the work it advocates. Moreover, private forestry enterprise, once its financial success is demonstrated, will increase at an ever-growing rate of speed. It will far outstrip anything the Government can do. It is much more desirable that the forestry practised by the Government should be imitated, for although we may constantly preach that forestry is an attractive financial investment, we must be able to point to definite results to prove our assertions. It is self-evident that forestry, if it is to be continued by private enterprise, must be profitable or else it would not be extended. This opportunity is far too important to be neglected. Most co-operators will naturally regard the project merely as a business proposition—as a matter of dollars and cents—and we should not attempt such work until we have the solid ground-work of first-hand experience to stand on. An initial failure would be even more infectious than an initial success.

While the exact terms of co-operation may well vary with each project, in general it is only fair to have the co-operator pay all expenses for seeds, trees, and labour, and in some cases even the salary of the member or members detailed to the project. In other cases, and especially when dealing with schools, universities, and other institutions of a more or less philanthropic character, the Government may supply free the technical advice and supervision, leaving the other expenses to be borne by the co-operator.

Appropriations.

At the present time, the appropriations for the support of the Forest Service are made directly by the Central Government through the Ministry of Agriculture and Commerce, and, so far as can be foreseen, this will for some time continue to be our main source of revenue. There are two or three other sources, however, from which additional funds can be secured. First (of comparatively little importance), from co-operators, as discussed above; and second, from provinces by appropriations for the maintenance of the forest commissioners with their respective staffs. This was provided for by Presidential Mandate at about the time the Forest Service was created, but up to the present time conditions have been too disturbed to permit of its more than partial realisation. A third source of revenue is, in my opinion, of much potential importance. There is a strong popular demand for young trees suitable for transplanting, a demand from owners of private estates, from railroad companies, from the provinces themselves, and from various other sources; and this demand could easily be very largely increased. So far as possible, therefore, in establishing forest nurseries throughout the provinces, we will endeavour to maintain them on a scale more than adequate for our own needs, disposing of the surplus stock at a price low in comparison with what would have to be paid if the Government nursery had not been established, but sufficient to enable us thereby to meet part, if not all, of the expenses of the entire nursery. As I have said above, forestry in China may be regarded as an attractive business proposition, and its returns should begin to come in within a surprisingly short time. They can, in fact, be made to begin within two or three years after the nursery is first established. I do not mean in any way to imply that prices for nursery stock would be fixed at a limit which would in the slightest discourage their purchase and use. The main object should be accomplished even if it should entail a continuous financial expenditure without direct monetary returns, but if the object for which the Forest Service exists can be accomplished more cheaply, it is not only our desire but our very distinct duty to the Chinese tax-payers to conduct our activities at the lowest possible cost. The money at our disposal will always be severely limited in comparison with the task

imposed upon us. A saving here or the making of a profit there means that there will be just so much more available for opening up needed projects elsewhere. And the demonstration by the Government of the financial profits which can be made from forestry in China, will be decidedly our most telling argument. If we cannot put forestry in China on a financially profitable basis, our work is doomed at the outset to severe limitation; but I am convinced that it is distinctly practicable, and that it will be our own fault if we fail.

Minor Activities.

In the paragraphs above, I have discussed the main lines along which our work will probably lie. There are other problems which I would have liked to discuss, especially that which has to do with protection, but the article has already become of undue length. Certain minor activities, however, which have been already undertaken and are now in full swing, may be mentioned. Among these are the translation into Chinese of elementary but thoroughly reliable text-books and reference books on forestry—for up to the present time forestry literature in Chinese is almost if not quite non-existent; the preparation of an English-Chinese glossary of technical terms used in forestry, in order that such practice may be kept uniform; the preparation of a check list (or dictionary) of Chinese forest trees, with their botanical and local names, their habitat, etc.; the beginning of a forest map of China, an unending task but none the less necessary; the collection of wood specimens, of a forest herbarium, of minor forest products, etc. All such work, while perhaps from one point of view of minor importance, has in the aggregate a very great influence in helping the Forest Service to accomplish the task it has been set to do: viz., to manage and increase the forest resources of the country so as to improve the comfort, prosperity and well-being of its inhabitants present and to come.

19. Chermesidæ in Relation to British Forestry.

(*With Plates.*)

By H. M. Steven, B.Sc.(Forestry), Carnegie Research Scholar in Entomology, the University of Edinburgh.

I.—INTRODUCTION.

The Family Chermesidæ possesses several well-marked features.

(*A*) The species are exclusively enemies of coniferous trees.

(*B*) Normally two hosts and a period of two years are required for their complete development. When two hosts are necessary, one of them is always a species of spruce (genus *Picea*), while the other may be a species of pine (genus *Pinus*), larch (genus *Larix*), or silver fir (genus *Abies*); there is an American species attacking Douglas fir (genus *Pseudotsuga*). The spruce is called the Primary Host, and on it a gall is produced. The other trees are termed Intermediate Hosts; no gall is produced on any intermediate host.

(*C*) As in other Aphids all the individuals of a species are not of the same form, but a series of generations follow one another, each being more or less different from the one which produced it. The following are the generations found in the Family Chermesidæ :—

(1) *Fundatrix Generation.*—The first-stage larva hatches in autumn. It settles on or near a spruce bud, secretes "wool," from dorsal wax-glands for protection and passes the winter. Development is completed in spring, and the adult lays a large number of eggs. This generation consists entirely of females, which are wingless in all stages. Its feeding habits cause the needles of the opening bud to be stunted and swollen.

(2) *Gallicola Generation.*—The larvæ crowd amongst the swollen needles, and as a result of their feeding a more or less compact gall is formed. When these larvæ have reached the nymph stage, rudimentary wings being present, the gall dries and opens. The nymphs climb out, moult, and become winged adults. This generation consists entirely of females. The Gallicolæ may settle on the spruce, giving rise to Generation I., Gallicolæ non-migrantes, or may migrate to the needles of the intermediate host, Gallicolæ migrantes, and there lay eggs.

(3) *Colonici Generation.*—The first-stage larvæ migrate from the needles to the bark of the intermediate host and there pass the winter. In spring they wake up, feed, moult, and become adult. All stages are wingless, and the generation consists entirely of females. From their eggs two types of larvæ may hatch.

(*a*) *Sistens.*—These are identical with the larvæ of their parent, and remain undeveloped for a longer or shorter period.

(*b*) *Progrediens.*—These larvæ develop immediately, and may become wingless females which produce a series of similar generations on the needles of the intermediate host.

(4) *Sexupara Generation.*—The Progrediens larvæ may become nymphs, and then winged adults which are all females. They migrate back to spruce and lay a small number of eggs on the needles.

(5) *Sexuales Generation.*—Larvæ hatch from these eggs and develop into males and females, wingless in all stages. When adult the female lays a single, large fertilised egg under a bark scale. This egg gives a first-stage Fundatrix larva.

(*D*) Sexual reproduction is restricted in this family, for females only are found in Generations 1-4 inclusive. Stalked eggs are laid by the females of the *Chermes* species.

Many of the great forest biologists, such as Hartig and Ratzeburg, studied these insects, but little progress was made until it was discovered that two hosts were necessary for the complete development of the species. This discovery was made independently by Blochmann, Cholodkovsky, and Dreyfus during 1889. Cholodkovsky has continued his researches until the present day, while during the last ten years Börner and Nüsslin in Germany and Marchal in France have increased our knowledge of this difficult group. Although these pests are widely distributed in Britain, little or no research has been done on the family in this country. Buckton's descriptions in *British Aphides*, vol. iv., were made before the discovery of the migrations between the primary and intermediate hosts, and are therefore incomplete and misleading. In 1908 Burdon published several papers, including a critical review of Cholodkovsky's first monograph (*Jour. of Econ. Biol.*, vol. ii.,

1907-8, pp. 1-13, 119-148). These papers did much to spread a more accurate knowledge of the group in this country. Since that date a great advance in our knowledge of this family has been made, but the results of these recent continental researches are not generally available to foresters. My researches and observations on the Chermesidæ have enabled me to test these results, and the statements on the life-histories refer to my observations for this country unless otherwise stated.

The most recent classification raises the Chermes group to family rank, and divides the genera of that family into two tribes, as follows :—

Family CHERMESIDÆ.

Tribe Pineini.

Genus *Pineus*, Shimer.

Tribe Chermesini.

Genera *Chermes*, Börner ; *Gillettea*, Börner; *Aphrastasia*, Börner; *Dreyfusia*, Börner; *Cnaphalodes*, Macquart.; and *Cholodkovskya*, Börner.

For convenience in treatment, I group the genera according to their hosts. The following genera have been found in Britain :—

Spruce–Larch Series.

Genera *Chermes*.
Cnaphalodes.

Spruce–Pine Series.

Genus *Pineus*.

Spruce–Silver Fir Series.

Genus *Dreyfusia*.

II.—LIFE-HISTORIES.

1. Spruce-Larch Series.

The species of two genera of the Family Chermesidæ, namely, *Chermes*, s. str., and *Cnaphalodes*, are found on spruce and larch. In each genus there is one, or probably two, species whose cycles are passed on both spruce and larch, while there is one species which completes its life-history on spruce only.

Besides differing in structure, the species of the two genera can be differentiated on the two hosts as follows:—

Chermes, s. str.	*Cnaphalodes*.
Spruce—(1) The Fundatrices feed *at the base of* fairly strong buds; (2) the galls rarely terminate the shoots, and only the needles on one side of the shoot are galled (Plate II. Fig. 1).	(1) Fundatrices feed *on* shaded, hence weak, buds. (2) The galls usually terminate the shoots, and all the needles of the bud are galled (Plate II. Fig. 2).
Larch—(3) The Colonici feed on the bark of the trunk and branches of the larch, and they secrete much "wool" (Plate II. Fig. 3).	(3) The Colonici feed at the base of the dwarf shoots of older larch, and on trunks of very young trees. They secrete very little "wool" (Plate II. Fig. 4).

The following is an account of the life-histories of the species of the two genera as shown by my researches:—

Genus Chermes, s. str. (Börner).

Chermes abietis (Kalt.).

The life-cycle of this species consists of two generations—Fundatrix and Gallicola non-migrans—and is passed on spruce only. It takes only one year to complete.

(1) *Fundatrix Generation.*—The Fundatrices hatch during August and September from eggs laid by the Gallicolæ non-migrantes. They are yellow in colour. After wandering over the branches of spruce, they settle down in a crevice at the base of a fairly strong bud, generally on the under side. After they insert their suctorial mouth apparatus, they secrete short, curly "wool," which gives them a grey appearance. Thus they pass the winter. These first-stage larvæ wake up in March, and commence to feed. They moult three times during April, and become adult at the beginning of May. The adult females lay 40–60 yellow eggs under the protection of copious "wool." The feeding of the Fundatrices causes the needles on the lower side of the open bud to remain stunted,

PLATE II.

FIG. 1. Type of Gall of the Genus *Chermes*, s. str. just before opening.

FIG. 2. Gall of the type of the Genus *Cnaphalodes*, just before opening.

[*To face p.* 134.

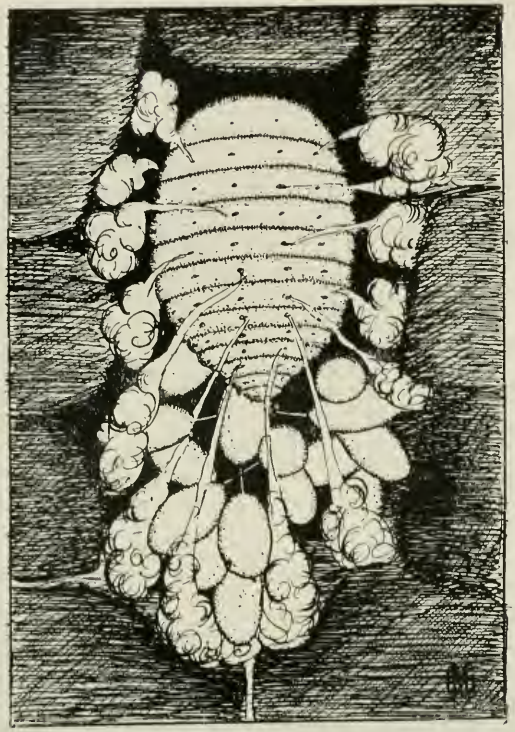

FIG. 3. Type Genus *Chermes*, s. str., on larch. Colonist of *Ch. viridis*, Ratz., while laying eggs in a crevice of the bark of larch (original).

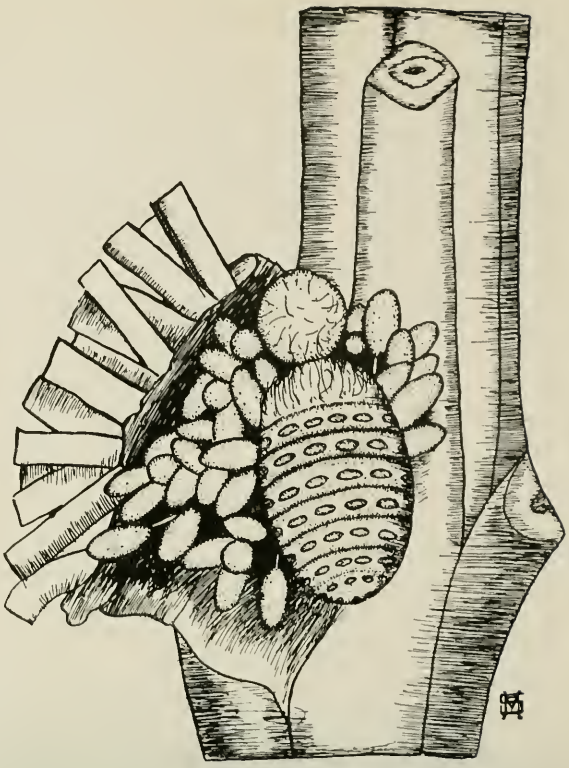

FIG. 4. Type Genus *Cnaphalodes* on larch. Colonist of *Cn. strobilobius*, Kalt., while laying eggs on larch twig (original).

and to become pale and swollen. Later, numerous red papillæ appear on the swollen parts.

(2) *Gallicola Generation.*—The larvæ hatching from the eggs laid by the Fundatrices crowd amongst the deformed needles of the spruce bud. As a result of the feeding of these larvæ, the swollen needles close together, forming a compact gall consisting of chambers in which the larvæ feed (Plate II. Fig. 1). The third moult gives a nymph stage, characterised by rudimentary wings. When this stage is full-fed, the gall turns brown and opens. The nymphs climb out, and the fourth moult gives the yellow adult, Gallicolæ non-migrantes. These settle on the spruce on which they were born, or on adjacent spruce, and lay 25–40 bright yellow eggs. No "wool" is secreted by these Gallicolæ. The eggs hatch in two to three weeks. Development within the gall is variable, and the galls of this species open from the second half of July until mid-September.

Chermes viridis (Ratz.).

The life-cycle of this species consists of five generations—Fundatrix to Sexuales. It is passed on spruce and larch, and takes two years to complete.

(1) *Fundatrix Generation.*—The Fundatrix hatches from a fertilised egg during the latter half of August. In spring, when adult, it lays 40-50 green eggs under some "wool." It in all other ways resembles *Ch. abietis*, Kalt.

(2) *Gallicola Generation.*—The development of the larvæ of the Gallicolæ and of the gall is as in *Ch. abietis*, Kalt. The galls open in the second half of July, or the first half of August. The reddish-yellow Gallicolæ migrantes migrate from the spruce to the needles of larch. There they lay 25-30 dark green eggs. No "wool" is secreted by the adult Gallicolæ.

(3) *Colonici Generation.*—These eggs hatch in about three weeks. The dark green larvæ migrate from the needles to the bark of the trunk or of the branches of larch. They settle in a crevice and secrete short curly "wool," which gives them a grey appearance. Parts exposed to intense light, such as the tops of trees and the upper sides of branches, are avoided. In March these larvæ wake up and feed. They moult three times and become adult towards the end of April. Each green female lays 20-30 green eggs under the protection of copious

"wool" (Plate II. Fig. 3). These eggs hatch in three weeks, giving two types of larvæ, namely—

(*a*) Progrediens larvæ, which migrate to the needles.

(*b*) Sistens larvæ, which generally settle round their dead mother and remain undeveloped until the following spring. Some climb on to the needles and perish.

(4) *Sexupara Generation.* — The Progrediens larvæ (3 *a*) are green in colour, and they feed on the larch needles from mid-May to mid-June. The needles lose their chlorophyll and become bent. The third moult gives the nymph stage, and the fourth the adult Sexupara. This winged female is green in colour and secretes some "wool." The Sexuparæ migrate to the 1 to 3-year-old spruce needles, and there lay about ten yellow green eggs under cover of the wings and a little "wool." It is rare to find them on the needles of the current shoots.

(5) *Sexuales Generation.*—The larvæ of the males and females hatch in two to three weeks. After four moults they become adult, and the female lays a single fertilised egg under a bark scale. This egg is yellow-green in colour; it hatches in about three weeks, giving a greenish fundatrix.

There is probably a third species of this genus whose life-cycle consists of five generations which resemble those of *Ch. viridis*, Ratz. This species, however, possesses both Gallicolæ non-migrantes, remaining on spruce, and Gallicolæ migrantes, migrating to larch. Börner considered that this species was the only one of this genus, and named it *Ch. abietis* (L.), Börner. Cholodkovsky considered that it was confined to Western Europe and named it *Ch. occidentalis*, Chol.

Genus Cnaphalodes (Macquart.).

Cnaphalodes lapponicus (Chol.).

The life-cycle of this species consists of two generations—Fundatrix and Gallicola non-migrans—and is passed entirely on spruce. The cycle is completed in one year.

(1) *Fundatrix Generation.*—The Fundatrices hatch during August, September, and October, from eggs laid by the Gallicolæ non-migrantes on spruce. They are reddish-brown in colour at first, and gradually they turn very dark brown. They

settle actually on the buds of thin shaded branches. Each larva secretes long, single, coarse strands of "wool," which give it a plumose appearance. Thus protected the larvæ pass the winter. The first-stage larvæ wake up during April, feed, moult three times and become adult about mid-May. Each female lays 50-100 brownish-green eggs under the protection of copious "wool." The effects of the sucking of the Fundatrices is clearly visible by the end of May. The needles of the opening bud remain stunted; they are pale in colour, except at the tips, which are frequently rose-coloured.

(2) *Gallicola Generation.*—The larvæ hatch out during June. As a result of their feeding the galls close up about mid-June. Larvæ, hatching out later, have to remain on the outside of the gall, and their presence is characteristic for galls of this genus. The growing points are usually killed so that the galls terminate the twigs (Plate II. Fig. 2). The development within the gall is very variable. In some cases the three moults have taken place and the nymph stage reached by the middle of July. The galls open and the nymphs climb out. They moult and became winged adult females. These red Gallicolæ settle on the spruce on which they were born, or on adjacent spruce. Each female secretes "wool" and lays 20-40 orange-coloured eggs. These eggs hatch in two to three weeks and give Fundatrices. In other galls development is slower, such galls opening in August or in September.

Cnaphalodes strobilobius (Kalt.).

The life-cyle of this species consists of five generations—Fundatrix to Sexuales. It is passed on spruce and larch and takes two years to complete.

(1) *Fundatrix Generation.*—The Fundatrix hatches from a fertilised egg in August. Appearance, hibernation, and development is as in *Cn. lapponicus.*

(2) *Gallicola Generation.*—The formation and appearance of the gall on spruce is as in *Cn. lapponicus.* Development within the gall of this species, however, is rapid and uniform. The galls open during the first half of July. The red nymphs climb out and moult on the needles surrounding the gall. The red Gallicolæ migrantes migrate to the needles of larch and there lay 20-30 brownish eggs. No "wool" is secreted by the

Gallicolæ of this species, which differ thus from those of *Cn. lapponicus.*

(3) *Colonici Generation.*—The eggs hatch in about three weeks. The dark brown larvæ migrate from the needles of the larch to the twigs in the case of older trees, and to the trunk in the case of very young trees. They hibernate without secreting any "wool." These first-stage larvæ wake up in March, feed, moult three times and become adult during the first half of May. Each bronze-green female lays 35-50 eggs (Plate II. Fig. 4). The colour of the eggs is bronze-green with a purplish tinge, but the powdery "wool" secreted by the last segments of the female's body gives them a grey appearance. These eggs hatch in about three weeks and give two types of larvæ.

(i.) A very small number of Sistens larvæ, which settle on the twig and remain undeveloped until the following spring.

(ii.) A large number of Progrediens larvæ. These larvæ are black and migrate to the needles. They feed there during June and cause the needles to bend fantastically. The third moult results in two types.

(*a*) Nymphs of the Sexupara generation.

(*b*) Wingless forms.

The latter moult and become adult wingless Progredientes. Each brown female lays 20-30 brown eggs under copious "wool" secreted by the adult. These eggs hatch in two to three weeks, and give a small number of Sistens larvæ and a large number of Progrediens larvæ. These latter develop on the needles into a second generation, which becomes adult from mid-July onwards. A third generation becomes adult during August. From the eggs laid by the females of this generation, a large number of Sistens larvæ hatch and a small number of Progrediens larvæ. The former pass the winter together with the Sistens from the Colonici eggs, the Sistens from the Progredientes eggs, and the Sistens from the eggs laid by the Gallicolæ migrantes from spruce, while the latter perish.

(4) *Sexupara Generation.* — For early development see Colonici (ii. *a*). The nymphs moult during the second half of June, and the reddish adult Sexuparæ migrate to the needles of spruce. There, each lays about ten yellow-brown eggs under cover of the wings and copious "wool."

(5) *Sexuales.*—The larvæ of the males and females hatch out in about three weeks. They feed and moult four times. The female lays a single fertilised yellow egg which hatches in three to four weeks, giving a Fundatrix.

According to Börner there is a species of this genus *Cnaphalodes strobilobius* (Kalt., Börner) similar to *Cn. strobilobius* (Kalt.), but possessing both Gallicolæ migrantes migrating to larch and non-migrantes remaining on spruce. Cholodkovsky has found a species in Russia which he names *Chermes* (*Cnaphalodes*) *lapponicus*, Chol., var. *præcox*, Chol. The galls open in June, and the Gallicolæ remain on spruce but do not secrete "wool."

2. Spruce–Pine Series.

This series is made up of one genus, the genus *Pineus* (Shimer). There are two species of this genus, namely, *Pineus pini* (L.), Börner, and *Pineus strobi* (Htg.), Börner. The life-cycle of the former species is passed on Oriental spruce (*Picea orientalis*) and various pines, but principally Scots pine (*Pinus silvestris*), while the life-cycle of the latter is passed on Weymouth pine (*Pinus strobus*). These *Pineus* species are closely allied, but they differ both in structure and in life-history.

Genus Pineus.

Pineus pini (L.), Börner.

According to Cholodkovsky and Marchal this species is made up of two biological races, identical in structure but differing in life-history as follows:—

(*A*) The Indigenous race, whose life-cycle is passed principally on pine. The cycle is a yearly one.

(*B*) The Oriental race, whose life-cycle is passed on Oriental spruce (*Picea orientalis*) and pine. This cycle takes two years to complete.

The differentiation of the species *Pineus pini* into these two races does not appear to be sharp, but to be largely dependent on the absence or presence of *Picea orientalis*. My researches only revealed the Indigenous race, but as galls of *Pineus pini* have been found on *Picea orientalis* in this country, both races are, no doubt, present.

(*A*) The Indigenous Race of *Pineus pini.*

(1) *Fundatrix Generation.*—None.

(2) *Gallicola Generation.*—None.

(3) *Colonici Generation.*—The hibernating insect in this species is not a first-stage larva, as in other Chermesidæ, but a third- or fourth-stage larva. These larvæ pass the winter under the protection of "wool" at the bases of buds and needles, and in crevices in the bark of branches and of the trunk of Scots pine (Plate III. Fig. 5). The larvæ wake up during March, and feed and moult for the fourth and last time. The adult females each lay, during April, about 100 orange-coloured eggs under copious "wool." These eggs hatch during the second half of May. According to Marchal, these larvæ are all of the Progrediens type. Many of these red larvæ crowd at the bases of the needles of the opening buds. They secrete "wool," and frequently the new shoots are whitened. They feed and moult. The third moult gives two forms.

(i.) Nymphs, which moult and become winged adults and climb on to the needles. These winged females consist of two kinds—

(*a*) Sexuparæ (*see Sexupara Generation*).

(*b*) *Colonici alatæ.*—These remain on the pine needles, and lay 10–20 orange-coloured eggs under copious "wool." The eggs hatch in about three weeks, giving larvæ of Colonici. The larvæ become adult towards the end of July. The eggs laid by these adults give larvæ which, after two or three moults, hibernate.

(ii.) Wingless females, which become adult after the fourth moult. These females lay 25–30 orange-coloured eggs at the bases of buds and on the stems at the beginning of July. The eggs hatch in about three weeks, and the larvæ develop on the stems. After four moults they become adult, and lay eggs towards the end of August. The larvæ hatching from these eggs moult two or three times, then hibernate.

(4) *Sexupara Generation.*—For early development see *Colonici Generation* (i. *a*). The Sexuparæ become adult during the second half of June. They migrate to the needles of *Picea excelsa*, but preferably to those of *P. orientalis.* Each female

FIG. 5. Scots pine (*Pinus silvestris*) badly infested by *Pineus pini* (from Marchal).

[*To face p.* 140.

FIG. 6. Colonici of *Dreyfusia Nüsslini*, surrounded with wool, laying eggs on a twig of silver fir (*Abies nordmanniana*).

FIG. 7. Progrediens larvæ of *Dreyfusia Nüsslini* feeding on the young needles of silver fir (*Abies nordmanniana*), and causing them to curl in a characteristic way.

lays about ten yellow eggs under the protection of copious "wool." Many of these eggs do not hatch.

(5) *Sexuales.*—According to Marchal, only females hatch from these eggs. Many die during development, while those reaching the adult stage are unable to carry on the cycle owing to the absence of the males.

The following is a diagram showing the life-cycle of *Pineus pini*, Indigenous race, according to Marchal. The main points have been confirmed for this country by my researches:—

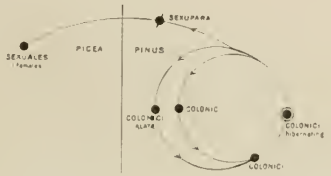

FIG. 1.—Diagram of the Life-Cycle of *Pineus pini* (Indigenous race), according to Marchal.

(*B*) The Oriental Race of *Pineus pini*.

I have not found this race even where *Picea orientalis* was present. The descriptions are according to Börner and Marchal.

(1) *Fundatrix Generation.*—The Fundatrix hatches out on the *Picea orientalis* in the second half of July. It anchors itself at the base of a needle (not bud) on the shoot of the current year. This larva secretes coarse, single strands of "wool," and thus passes the winter. These larvæ wake up in March, feed, moult three times, and become adult during the second half of April. Each female lays numerous orange-coloured eggs under copious "wool." As the Fundatrix is situated at some distance from the extremity of the twig, its feeding has little effect on the needles of the opening bud.

(2) *Gallicola Generation.*—The larvæ crowd amongst the needles of the opening buds of the *Picea orientalis*. Their feeding produces a long, loose gall. These larvæ moult four times within the gall, the nymphs generally moulting before issuing from the gall. The gall turns purplish and opens towards the end of June. The winged Gallicolæ migrate from the *Picea orientalis* to the needles of Scots pine, and there lay 20-40 yellowish-brown eggs under some "wool." These eggs hatch in two to three weeks.

(3) *Colonici Generation.*—The resulting larvæ moult four times and become wingless adults. Egg-laying is spread over a considerable time. The larvæ hatching from these eggs moult two or three times, then hibernate. In this species, therefore, the hibernating larvæ on the intermediate host do not hatch from eggs laid by the Gallicolæ as in other Chermesidæ, but from eggs laid by descendants of the Gallicolæ.

Development in spring and summer is as in "(*A*) The Indigenous Race," but more Sexuparæ than *Colonici alatæ* are produced.

(4) *Sexupara Generation.*—Development is as in "(*A*) The Indigenous Race." The winged Sexuparæ migrate to the needles of *Picea orientalis*, very rarely to *P. excelsa*. This migration takes place in the second half of June. Each female lays about ten yellow eggs under the protection of "wool."

(5) *Sexuales.*—Larvæ of both males and females hatch out from these eggs. After four moults they become adult, and each female lays a single yellow fertilised egg on the twig of *Picea orientalis*.

The following is a diagram illustrating the life-history of *Pineus pini* (Oriental race), according to Marchal :—

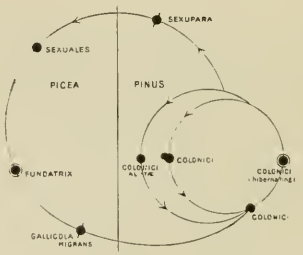

FIG. 2.—Diagram of the Life-Cycle of *Pineus pini* (Oriental race), according to Marchal.

Pineus strobi (Htg.), Börner.

In Europe this species is only found on Weymouth pine (*Pinus strobus*). Marchal observed that the Sexuparæ settled on the needles of black spruce (*Picea nigra*) and laid eggs. Only females issued from these eggs, thus the cycle was similar to that of *Pineus pini* (Indigenous race). As both *Picea nigra* and *Pinus strobus* are East American trees, it is possible that

there is a normal migration of this species between these two hosts in their natural habitat.

(1) *Fundatrix Generation.*—None in Europe.

(2) *Gallicola Generation.*—None in Europe.

(3) *Colonici Generation.*—The cycle is similar to that of *Pineus pini*, but only on Weymouth pine (*Pinus strobus*). No *Colonici alatæ* have been observed in Europe.

(4) *Sexupara Generation.*—In Europe the Sexuparæ migrate to common spruce (*Picea excelsa*) and perish.

(5) *Sexuales.*—None in Europe.

3. Spruce–Silver Fir Series.

This series is made up of one genus in this country, the genus *Dreyfusia* (Börner). There are two species of this genus, namely, *Dreyfusia piceæ* (Ratz.), Börner, and *Dreyfusia Nüsslini*, Börner. The former lives entirely on various species of silver fir, while the life-cycle of the latter is passed on *Picea orientalis* (rarely on *P. excelsa*), and on *Abies nordmanniana* and *A. pectinata*. The history of the silver fir *Chermes* is very interesting. It appears that only the species named by Ratzeburg as *Chermes piceæ* was originally present in Europe. This species is typically found on the bark of old silver firs and does little damage. Later the silver fir *Chermes* became a much more serious enemy. *Abies nordmanniana* was first of all principally attacked, but later *A. pectinata*, the indigenous silver fir, also fell a victim. For a long time it was not known that a new species had made its appearance. Cholodkovsky, Nüsslin, and others, however, observed that while the old *Chermes piceæ* lived entirely on silver fir, the winged forms now arising on that conifer migrated to *Picea excelsa*, but only very rarely completed its cycle on this spruce. Cholodkovsky considered this migrating race to be the species which Dreyfus had observed and named as *Chermes funitectus*. Later it was found that this species completed its cycle on the Oriental spruce, *Picea orientalis*. Börner pointed out the structural differences between the two species. He rejected the specific name "*funitectus*," as Dreyfus had originally found that species on *Tsuga canadensis*; but probably Dreyfus wrongly identified the host. Börner named this species *Dreyfusia Nüsslini*. Marchal has closely studied the life-histories of the two silver-fir species, and his conclusions have, in the main,

been confirmed by my observations and experiments in this country.

Genus Dreyfusia (Börner).

Dreyfusia Nüsslini (Börner).

The spruce host of this species is *Picea orientalis*, and the silver-fir host, *Abies nordmanniana* and *A. pectinata*. The natural habitat of both *A. nordmanniana*—on which silver fir this *Chermes* first appeared—and *Picea orientalis* is the south-east of Europe and Asia Minor. It is, therefore, probable that *Dreyfusia Nüsslini* was originally confined to that region, and that it was introduced to middle and western Europe on *Abies nordmanniana*. Later it established itself on the indigenous silver fir, *A. pectinata*. In some parts of Normandy, Marchal only found the indigenous species, *Drey. piceæ*, but both species appear to be widely distributed in Britain. When *Picea orientalis* is absent this species carries on indefinitely on silver fir, and this is the normal life-cycle in this country.

(1) *Fundatrix Generation.*—The fertilised egg hatches on *Picea orientalis* in August. The first-stage larva passes the winter *on* a bud of that spruce. It is black in colour, and surrounding it and along its crest are bands of "wool." In spring the larvæ wake up, feed, moult three times, and become adult in April. Each female lays a large number of reddish eggs under some "wool." The feeding of the Fundatrix in this species, as in the genus *Cnaphalodes*, plays an important part in the formation of the gall.

(2) *Gallicola Generation.*—The larvæ hatch out in the second half of May and crowd amongst the deformed needles. As a result of their feeding a compact, spherical gall is formed. In most cases the growing point is killed. At first the gall is reddish in colour, later green with deep-crimson bands along the lines of fusion of the needles. The third moult gives the nymph stage. When the nymphs are full-fed the chambers of the gall open and the nymphs climb out. They moult, becoming crimson-winged Gallicolæ. In Scotland the galls open in mid-July. The Gallicolæ migrantes migrate to the needles of silver fir and lay a number of reddish eggs, generally on the under side of the needles. Short, coarse, curled strands of "wool" are secreted by the Gallicolæ.

(3) *Colonici Generation.*—The eggs laid by the Gallicolæ on the silver fir hatch in the first days of August. The small red larvæ migrate from the needles and anchor themselves on the stem, at the bases of needles, and on buds. Each secretes wool along the margin and crest of the body, and thus passes the winter. These Sistens larvæ wake up in March, or earlier if the season be mild. They feed, moult three times, and become adult towards the end of April. Each female lays a large number of reddish-orange eggs under "wool" (Plate III. Fig. 6). These eggs hatch in about three weeks and give two kinds of larvæ.

(*a*) *Sistens Type.*—These larvæ are identical in form with the hibernating larvæ. They settle down around their mother on the bark of the shoot or on the buds, secrete "wool" as do the hibernating larvæ, and thus pass the summer and winter undeveloped. My observations showed that more than half the larvæ hatching out were of this type. According to Marchal, some of these larvæ develop and become adult during the late summer. They lay eggs from which issue Sistens larvæ which hibernate.

(*b*) *Progrediens Type.*—The larvæ of this type climb on to the underside of the needles of the silver fir, and feed (Plate III. Fig. 7). These larvæ develop into two different forms. According to Marchal, the difference appears after the second moult. The third moult gives—

(i.) Nymphs of the Sexupara Generation.
(ii.) Wingless larvæ.

These latter larvæ moult a fourth time, becoming adult, wingless Progredientes during the second half of June. Each Progrediens lays a number of reddish eggs on the underside of the needles of silver fir, under the protection of copious "wool." These eggs hatch in about two weeks. According to Marchal, they give Sistens larvæ which migrate to the branches and buds. Some remain undeveloped until the following spring and some develop. These latter moult three times and become adult. Each lays a number of eggs which, on hatching, give Sistens larvæ which pass the winter along with the other first-stage Sistentes.

(4) *Sexupara Generation.*—The Sexuparæ hatch out and develop on the needles of the silver fir as described under Colonici (*b* i.). The fourth moult gives the adult, winged Sexuparæ. These deep red Sexuparæ migrate to the needles of *Picea orientalis* and *P. excelsa.* Each secretes coarse strands of wool and lays about ten reddish eggs. The development is very rarely completed on common spruce (*P. excelsa*).

(5) *Sexuales Generation.*—The eggs laid by the Sexuparæ on the needles of *Picea orientalis* hatch in about three weeks. The reddish larvæ of the males and females first feed under their mother, but later openly on the needles. They moult four times and become adult at the beginning of August. Each female lays a single, fertilised reddish-orange egg, near a bud, under a little "wool." This egg hatches in three to four weeks and gives a first-stage larva of a Fundatrix.

The following is a diagram of the life-history of *Dreyfusia Nüsslini*, according to Marchal:—

FIG. 3.—Diagram illustrating the Life-History of *Dreyfusia Nüsslini*, according to Marchal.

Dreyfusia piceæ (Ratz.), Börner.

This species appears to be indigenous in Western Europe. It, no doubt, originally was present only on *Abies pectinata*, but now is found on most silver firs. In this species the cycle on spruce has been completely obliterated, so that it carries on entirely on the intermediate host. Marchal has worked out the life-history, and I have been able to confirm some of his observations for this country.

(1) *Fundatrix Generation.*—None.

(2) *Gallicola Generation.*—None.

(3) *Colonici Generation.*—The winter is passed as first-stage

larvæ of the Sistens type. They are anchored in the crevices of the bark of the trunk and older branches of large trees, and at the base of the buds or shoots of small trees. These larvæ may moult once or twice before spring, or may remain undeveloped until spring, according to weather conditions. After three moults each female lays a very large number of reddish eggs, generally during the second half of April. Only a little "wool" is secreted. Two kinds of larvæ hatch from these eggs.

(*a*) *Progrediens Type.*—These larvæ migrate to the needles or the axils of the needles. They moult four times, and during their development two forms are differentiated.

(i.) Nymphs, later adult winged *Colonici alatæ*. These winged females settle on a needle of the silver fir and lay a few eggs from which issue Sistens larvæ.

(ii.) Adult wingless females each of which lays 10-12 orange-coloured eggs under copious "wool." From these eggs issue Sistens larvæ.

(*b*) *Sistens larvæ.*—These larvæ settle in excavations left by the fallen needles, and in other sheltered parts of the branches and trunks. These larvæ develop after a resting period, and become adult at the beginning of July. Each female lays a number of eggs under "wool." Sistens larvæ hatch from these eggs. Some of these larvæ remain undeveloped until the following spring.

The Sistens larvæ, hatching from the eggs laid by the *Colonici alatæ* (*a* i.), the Progredientes (*a* ii.), and the majority of those hatching from the eggs laid by the first summer Sistens generation I. (*b*), develop in August and September. When adult, these wingless female Sistentes (summer Sistens generation II.) each lay a number of eggs under the protection of "wool." From these eggs issue Sistens larvæ, which pass the winter together with the progeny of the first summer Sistens generation I., which remained undeveloped.

(4) *Sexupara Generation.*—None.

(5) *Sexuales Generation.*—None.

The following is a diagram illustrating the life-history of *Dreyfusia piceæ*, according to Marchal:—

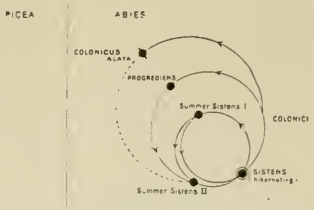

FIG. 4.—Diagram of the Life-History of *Dreyfusia piceæ*, after Marchal.

III.—RELATION TO FORESTRY.

From a variety of reasons, conifers have become more and more the principal forest trees in temperate climates. As this tendency is likely to increase in the immediate future, it is becoming increasingly necessary that the diseases of coniferous trees should be understood. The Chermesidæ are all enemies of coniferous trees, and these our most important conifers, namely, spruce, larch, pine, silver fir, and, in America, Douglas fir. The damage done by these pests is largely dependent on the vigour of the hosts. Thus, when the environment of the conifers is ideal, the damage done by the *Chermes* species is not important, but the biological adaptations of the Chermesidæ are such that the slightest diminution in the health of the trees means that these pests become serious enemies. This varying damage, depending on the vigour of the hosts, explains, in part at least, the different estimates of the damage done by the Chermesidæ. In the following pages I have attempted to estimate the damage done to the various conifers by these pests under average conditions. As this is a very difficult matter, I shall be very pleased if foresters will assist by sending me estimates of the damage done by the Chermesidæ under the various conditions in this country. I have also attempted to estimate the relative immunity of the various exotic conifers to the European species of Chermesidæ. As the data for this are not too numerous, I shall also be pleased to have the assistance of members of the Society in this important question. On the other hand, we must guard against the introduction of non-European species of *Chermes*, *e.g.*, there is a species—*Gillettea cooleyi*—infesting Sitka spruce and Douglas fir. Galls of the European species of *Chermes* are common on Sitka spruce

in this country, but any appearance of *Chermes* on Douglas fir should be investigated, as it is highly desirable to conserve the relative immunity to disease which this conifer enjoys in Europe. I have also suggested a new method of control for these pests. This method aims at the destruction of the Chermesidæ before the conifers are dispatched from the forest nursery. This would ensure that the further distribution of these pests would be limited, and that the plants would get a chance to establish themselves in their new environment. This method should be specially applicable in this country, where extensive replanting will have to be carried out after the war.

1. Damage to the Hosts.

(*a*) Spruce.

(i.) Genera *Chermes*, s. str., and *Cnaphalodes*.—The sucking of the Fundatrices and Gallicolæ of the species of these genera cause the buds of spruce to be galled. *Chermes abietis* (Kalt.) and *Ch. viridis* (Ratz.) attack strong, growing buds, hence the damage is primary. In most cases the growing point is not killed, the shoot grows on, but is usually bent, and sometimes it dies in the following year (Plate II. Fig. 1). *Cnaphalodes lapponicus* (Chol.) and *Cn. strobilobius* (Kalt.) attack buds of thin, shaded branches, hence the damage is secondary. In most cases the growing point is killed, so that the gall terminates the twigs (Plate II. Fig. 2). The species of *Chermes*, s. str., usually attack the tree first, then as the tree becomes weakened, or the lower branches shaded, suitable food material for the species of *Cnaphalodes* is provided. My observations showed that the non-migrating species, *Ch. abietis* (Kalt.) and *Cn. lapponicus* (Chol.), did more damage to spruce than did the migrating species. The increase of these non-migrating species on a tree is very rapid once infection takes place. The damage done by the species of the genera *Chermes*, s. str., and *Cnaphalodes* is not serious when the spruce are healthy, but allied with unsuitable soil or atmospheric conditions, or both, the species of these genera, and especially the non-migrating species, may do serious damage to spruce.

(ii.) Genera *Dreyfusia* and *Pineus*.—*Dreyfusia Nüsslini* and *Pineus pini* produce galls on *Picea orientalis*. This conifer has not proved itself to be of silvicultural value in this country, hence the damage done to it need not be considered.

(*b*) Larch.

Larch has been widely planted in this country under conditions very different from those of its natural habitat, with a consequent weakening of the tree. This has made this conifer specially sensitive to its enemies in general and to Chermesidæ in particular. In most cases the species of both the genera *Chermes*, s. str., and *Cnaphalodes* are present on the same tree. The former is principally a bark feeder while the latter is a twig and leaf feeder, hence the one genus supplements the other to the detriment of the host.

(i.) Genus *Chermes*, s. str.—The Colonici are frequently so numerous as to whiten the bark of the trunk and branches of larch. After such an attack the bark usually turns black. As a rule the Colonici avoid strongly lighted parts of the tree, such as tops of exposed trees and upper sides of branches. The feeding of the numerous Colonici, at a time when growth should be at a maximum, must have a weakening effect on the tree. The punctures are a possible source of infection by wound parasitic fungi. The Sexuparæ generally feed on the needles of the elongating shoots, but as the duration of the feeding is short the damage is unimportant.

(ii.) *Genus Cnaphalodes.*—The Colonici feed on the dwarf shoots of older trees and on the bark of the branches and trunk of young trees of larch. The Colonici are frequently very numerous. The species of this genus are generally the first to attack the larch trees and are the species generally found on larch nursery stock. The species of *Chermes*, s. str., attack later on. In my opinion, the species of *Cnaphalodes* do the greatest damage in the Progrediens stage. The three or more generations of Progredientes feed on the larch needles during the summer, and are frequently so numerous as to whiten the needles of this conifer. As a result of this attack, the dwarf shoots and dormant buds may begin to grow. These succulent shoots, together with the elongating terminal shoots, provide additional food for the succeeding generations of Progredientes, so that the struggles of the tree to free itself only result in its still further weakening.

In my opinion the collective damage done to larch by the species of the two genera *Chermes*, s. str., and *Cnaphalodes*, is serious on many areas in this country.

(*c*) Pine.

Of the two species of *Pineus*, *Pineus pini* chiefly attacks Scots pine (*Pinus silvestris*), while *Pineus strobi* only attacks Weymouth pine (*Pinus strobus*).

(i.) *Pineus pini.*—The Colonici feed on in the crevices of the bark during spring, summer, and autumn. The Colonici may be so numerous as to whiten the bark with their "wool" (Plate III. Fig. 5). If the attack is very severe the Colonici may spread on to the needles and feed there. The *Colonici alatæ* feed on the needles for a short time. This species is frequently very troublesome in forest nurseries. If such infected trees are planted out on unfavourable areas, the check to the conifer may give the insect a chance to do damage, but if they are planted out on a favourable area the pines gradually clear of the *Chermes*.

(ii.) *Pineus strobi.*—The damage done by this species on Weymouth pine is similar to that done by *Pineus pini* on common pine.

On the whole the damage done by Chermesidæ to pine is much less serious than that done to the other intermediate hosts.

(*d*) Silver Fir.

(i.) *Dreyfusia Nüsslini.*—The numerous Colonici feed at the bases of the needles on the branches of young and old trees and on the trunks of young trees (Plate III. Fig. 6). The Sexuparæ and Progredientes feed on the needles, especially those of the opening buds. As a result of this sucking the needles of the opening buds remain stunted. Frequently they become curled in a characteristic way (Plate III. Fig. 7). Later they lose their chlorophyll and turn yellow; such needles fall off prematurely. This defoliation is serious, as silver fir takes about eight years to completely renew its needles. The greatest damage is done to young trees; but silver firs up to twenty-five years old may be attacked and in a few years killed by this species of Chermesidæ.

(ii.) *Dreyfusia piceæ.*—This species occurs on practically all silver firs. The Colonici feed in spring, summer, and autumn principally in crevices of the bark of old silver firs. The forms feeding on the needles do not appear to be common. This species does little or no damage to any silver fir except *Abies nobilis*. On this silver fir it is to be found feeding on the buds. Frequently large swellings appear on the infected branches, but

it is by no means established that this damage is solely due to the sucking of the *Chermes*.

Dreyfusia Nüsslini must be considered a dangerous enemy of silver fir. *Abies nordmanniana* is the conifer chiefly attacked, but the indigenous silver fir *A. pectinata* may be equally seriously attacked.

2. Relative Immunity of the Various Species of Conifers.

(*a*) Spruces.

(i.) Genera *Chermes*, s. str., and *Cnaphalodes*.—Common Norway spruce (*Picea excelsa*) is the favourite spruce host of the species of these genera, and if it is present in sufficient number other spruces are not attacked.

These species of Chermesidæ, however, can attack practically all spruces—*Picea orientalis* (Link. and Carr.), *P. alba* (Link.), *P. nigra* (Link.), *P. sitchensis* (Carr.), *P. morinda* (Link.), *P. polita* (Carr.), *P. pungens* (Engelm.), *P. Engelmanni* (Engelm.). Of the spruces used silviculturally in this country white spruce (*Picea alba*) and Menzies spruce (*P. sitchensis*) may be fairly badly galled, but only when the supply of Norway spruce (*P. excelsa*) fails.

(ii.) Genera *Dreyfusia* and *Pineus*.—*Dreyfusia Nüsslini* and *Pineus pini* rarely successfully attack any spruce other than *Picea orientalis*, so that the other spruces may be considered immune to these species.

(*b*) Larches.

European larch (*Larix europæa*, D.C.) is the favourite host of the species of the genera *Chermes*, s. str., and *Cnaphalodes*. I have found the Colonici of these species on Japanese larch (*Larix leptolepis*, End.) and other larches, but they were not numerous on these exotic species. Japanese larch appears to be relatively immune to Chermesidæ, at least in the presence of numerous European larch.

(*c*) Pines.

(i.) *Pineus pini*.—The favourite host of this species is the Scots pine (*Pinus silvestris*, L.), but it has been recorded from practically all pines, including *P. montana* (Duroi), *P. banksiana* (Lambert), *P. contorta* (Douglas), *P. insignis* (Douglas), and

P. laricio (Poiret). These species, however, are rarely attacked when *P. silvestris* is present in large numbers.

(ii.) *Pineus strobi.*—This species has only been found on Weymouth pine (*P. strobus*, L.), hence the other pines may be considered immune.

(*d*) Silver Firs.

(i.) *Dreyfusia Nüsslini.*—The history of this species in Western Europe is interesting, as showing how the Chermesidæ can adapt themselves rapidly to new hosts. At first *Abies nordmanniana* (Lmk.) was the principal host, and *A. pectinata* (D.C.) was relatively immune. Our indigenous silver fir was not able to keep this immunity, however, and is now severely damaged by this *Chermes*. I carried out infection experiments by Gallicolæ of *Drey. Nüsslini*, from a gall on *Picea orientalis*. The Gallicolæ were placed on *A. nordmanniana*, *A. firma*, and *A. grandis*. They laid eggs on the three silver firs, and these eggs duly hatched. The larvæ hibernated on the *A. nordmanniana*, and developed the following spring; but the larvæ on the other two hosts died a few days after hatching out. It would, therefore, appear that *A. firma* and *A. grandis* are relatively immune at present, but this requires further confirmation.

(ii.) *Dreyfusia piceæ.*—This species appears to attack all silver firs, but the damage which frequently follows an attack on *A. nobilis* makes it more conspicuous on this conifer.

3. Chermesidæ and Silvicultural Mixtures.

After the discovery that most species of Chermesidæ required two hosts for their complete development, it was suggested that these hosts should not be mixed together, *e.g.* the use of spruce and larch in the same mixture was deprecated. Recent research, however, has shown that, once infection has taken place, the species of Chermesidæ can carry on on either host without the other. For instance the non-migrating species *Chermes abietis* (Kalt.), and *Cnaphalodes lapponicus* (Chol.), are the more serious pests as regards spruce, while the species of the genera *Chermes*, s. str., and *Cnaphalodes*, appear to be able to carry on indefinitely on larch. Only the silver fir and pine parts of the life-cycles of *Dreyfusia Nüsslini* and *Pineus pini* respectively are common in this country, while *Drey. piceæ* and *Pineus strobi* are only found on

silver fir and Weymouth pine. It appears to me from careful observation that little or no good will follow any attempt to root out these pests by arranging the silvicultural mixtures so as to eliminate either of their hosts.

The second question to be considered is the possible effect of the substitution of exotic conifers, for those specially liable to attack, in silvicultural mixtures. As has been stated, practically all these exotic conifers have been attacked. Nevertheless, conifers such as Japanese larch, Menzies spruce, and Corsican pine are, at present, relative immune to attack by Chermesidæ. It remains to be seen, however, whether that relative immunity will be retained by these conifers. In view of the very severe damage which *Dreyfusia Nüsslini* does to *Abies nordmanniana* and *A. pectinata*, it is very necessary to seek a silver fir less liable to attack to take the place of these silver firs in our silvicultural mixtures.

4. Control.

I am convinced that there is no practical method of controlling the Chermesidæ once a plantation has been formed. Hence we must take advantage of every method of controlling these pests before and during the formation of a plantation, thus ensuring that the subsequent damage will be at a minimum.

We must first of all take advantage of silvicultural methods of controlling these pests. These are two in number, namely :—

(*a*) As the Chermesidæ become serious pests whenever the health of the conifers is impaired, great care should be taken to ensure that the conifer or conifers chosen for an area are clearly suited to the conditions of that area. It should always be remembered that if the soil or atmospheric conditions or both are inimical to the full development of the conifer or conifers, then in all probability, in a few years, the Chermesidæ will also have to be numbered among the adverse factors.

(*b*) The use of suitable confers, other than those which are the favourite hosts of the Chermesidæ, has been considered in the previous section.

Secondly, we must consider what means can be taken to ensure that the coniferous nursery stock, used in the formation of a plantation, are free from Chermesidæ. This will not ensure

that the wood will remain free from these pests as, in most cases, subsequent infection will take place, but it will ensure that the further distribution of the Chermesidæ will be limited, and that the plants will get a chance to establish themselves in their new environment. This is a very necessary precaution, as my observations showed that the Chermesidæ were frequently widespread in forest nurseries, and that these pests often did serious damage to their hosts immediately after a plantation has been formed. My experiments have shown that the fumigation of the nursery stock immediately before dispatch to the planting area is an efficient method of killing the Chermesidæ. This fumigation can be carried out any time during the winter and up to the 1st April. The nursery stock is placed in a gas-tight chamber and fumigated with hydrocyanic acid gas generated from potassium cyanide at the rate of 1 oz. to 100 cubic feet of space, or from sodium cyanide at the rate of 1 oz. to 130 cubic feet of space. This gas is highly poisonous but, provided reasonable precautions are taken, the method is absolutely safe. The cost is very small. This method could be used in any forest nursery however small; but it would be specially applicable if, in any scheme of afforestation, large forest nurseries and depots for distributing plants were established throughout the country.

For a more detailed account of the biology of the spruce and larch species, the reader is referred to my paper in the Royal Society of Edinburgh's *Proceedings* for 1917, where also full details will be found regarding the fumigation experiments. Appended to the Royal Society paper is a full list of references on the literature of the subject.

In carrying out my researches, and in the preparation of this paper, I have been indebted to the assistance of Prof. R. Stewart MacDougall, the Hon. Consulting Entomologist to this Society. I have also been indebted to Prof. I. Bayley Balfour, the Hon. Consulting Botanist to the Society, for facilities for observation and experiment granted in the Royal Botanic Garden, Edinburgh.

20. The Importance of Plantation Margins.

By Alexander Murray.

The most important matter connected with the rearing of plantations undoubtedly lies in the selection of suitable species for the margins, together with their after management. Unless this important matter is carried out on sound principles, it is hopeless to expect any plantation to reach maturity and produce the best commercial timber. In fact the whole life of the plantation, till it reaches maturity, may be said to be entirely dependent on the stability of the margins.

A great deal has been written on the varieties of trees which should be grown and the best methods of treatment; but seldom, if ever, has any reference been made to the formation and management of margins. Both in theory and in practice do we find that margins have been neglected. The trees forming these are generally the same species as are found in the interior of the plantation, and, what is often worse, the treatment meted out to them is often the reverse of what is required to train a substantial wind-screen.

It is generally found that the practice has been to thin the interior and leave the marginal trees close together, especially in exposed situations, in order that they may break the blast and give shelter to the interior. Under this treatment the trees become drawn-up, tall and slender, the side branches are destroyed, the trees become stunted in growth and covered with lichens, there is no room for root development, and, instead of forming a barrier to the wind, they are themselves laid low.

The lack of a good margin allows the wind to have full play underneath, so that the forest floor is swept clean for a considerable distance. The soil is thus robbed of that important part of a forest soil—the humus layer.

It has been well said by Sir Andrew Agnew, in his *Introduction to Forestry for Young People*, that by far the worst enemy of trees in Great Britain is the wind. Our woods and plantations will always be exposed to the danger of violent gales. This is a matter over which we have no control. We must, therefore, do our utmost to provide the best means of protection and reduce such damage to a minimum. This can only be done by the selection of species capable of resisting storms and violent gales. The treatment of these must be such as to encourage

the formation of strong roots and side branches, in order that they may be able to withstand the storms and protect the interior.

A good margin may be said to be of the same importance to a plantation as a good foundation is to a building, for in either case the one is entirely dependent on the other.

Our country is being rapidly denuded of its forests, and the question of reafforestation is now being seriously considered, and large areas will be afforested as soon as the state of the country will admit. It is not the object of this paper to point out by what means new forests are to be formed. Many proposals are being made, such as State assistance, State afforestation, remission of taxation, etc. But in whatever way new forests are to be formed, there is only one object in view, namely, the production of the greatest quantity of the most valuable timber. It is quite true that our country is capable of producing timber equally suitable for most of the purposes to which the foreign article has been applied, and it is surely a national disgrace not to do it.

Foreign timber is valued for its length of clean scantling and its closeness of grain. In producing this class of timber, the trees must of necessity be reared in close order, so that the side branches get suppressed before they attain to large size. In this way long, clean, and close-grained timber will be the result. It is evident, then, that trees reared in this order can ill withstand a vigorous climate, and to enable us to train up trees in this fashion some form of protection against the impetuous blast must be provided. Unless plantations are naturally sheltered, the only artificial means within our power is the formation of strong margins or shelter-belts. The advantages of a good margin will greatly depend upon the suitability of the trees forming it, while climate, altitude, exposure, and proximity to the sea must all be taken into consideration in choosing suitable species. The manner of planting the margins may be the same as the interior, except that I would like to say one word against the barbarous method of notch-planting. Under this system the roots are badly twisted and unable to develop evenly around the plant; consequently the trees are permanently less firmly rooted than those with equally developed roots. Happily this method of planting is now being superseded by the semicircular spade. Under this system

the roots are allowed to take up their natural position, fixing the trees more firmly in the soil.

When forming margins of plantations, it is generally advisable to plant moderately close, as this will provide a better selection for thinning.

Of whatever species the margins are formed, the thinnings ought to be at all times most carefully performed. The commercial value of the marginal trees should never be considered, as in every case their growth should be encouraged in such a manner as to produce the greatest amount of shelter. Each tree must, therefore, be allowed sufficient space for its full development of side branches and root ramification.

Thinning in this case must, therefore, commence before the side branches interlace each other, so that these branches may be preserved alive and thus present a full and close barrier to the wind.

A number of trees have the power of retaining their side branches alive to the ground for a number of years if provided with sufficient growing space. But all trees will ultimately degenerate into open order by losing their lower side branches. It is, therefore, necessary that the trees forming the extreme margin should not only have the peculiarity of growing bushy and retaining their side branches very low, but should consist of a kind which, on being pruned or cut back, will shoot afresh from the root or cut surface.

Whenever the species forming the outer margins develop into tall, scraggy trees, or show signs of decay by losing their foliage, they should be immediately cut back, part only being cut at a time. Young growths will then shoot out anew, and fresh green branches will be formed.

When this cut part has become sufficiently developed to protect the interior, other parts, if necessary, may be treated in the same manner. Such a margin should consist of three descriptions of trees.

For the principal or inside row perhaps no other trees are so well adapted as the common beech or the sycamore. The oak may often be found a good substitute for the beech on account of its deep-rooting qualities; other trees will thrive better underneath its shade.

The front or outside rows may then consist of several or all of the following species intermixed together:—beech, hornbeam

lime, Spanish chestnut, hawthorn, wild gean, hazel, willows, alder, and even the common silver fir. All these will respond well to having their heads and side branches cut occasionally. Such cutting will cause these species to throw out adventitious shoots from dormant buds, thus forming at all times a complete and close barrier of densely-clothed, healthy bushes to the wind. At the same time the inner trees, with their overhead spreading branches, will protect the interior.

When the plantation lies in proximity to the sea, such varieties as the elder, snowberry, sea buckthorn, and Austrian pine will be found suitable. On heath land at high altitudes the Scots pine may be found the best species, with a margin of the dwarf mountain pine, mountain ash, and birch.

Roadways are an absolute necessity in plantations, but the inlet or outlet is often a source of weakness to the plantation. What I have found to be a very good method is to form the inlet or outlet on a curve, or at an acute angle to the margin, for a distance of 30 to 40 yards, so that the wind driving in that direction will soon lose its force among the trees.

I have endeavoured to describe what I have observed in patches forming clumps or some part of a plantation margin, and although these have been generally reared for game cover, or amenity, they nevertheless provide a good illustration of what is required to form a complete forest margin.

Our prevailing winds are generally westerly—but there are many exceptions, and everything should be taken into consideration according to local circumstances. No effort should be spared to keep the margins in good health and close formation.

21. An Improved Transplanting Lath.

(With Plate.)

By J. Lyford-Pike, B.Sc.(Forestry), B.Sc.(Agriculture).

A topic of constant interest is the economical production of transplants with well-formed root-systems. There can be no question that well-formed roots are desirable, but the production of these is not always to be attained economically, when the work in the nursery has to be executed as speedily as possible, and when "piece-work" has frequently to be resorted to.

One of the most prolific causes of a bad root-system is the shallow preparation of the trench when lining-out in the nursery, and still more the scraping up of the earth to hold each individual plant in position before the line is filled in. Unless great care is exercised in these stages, a bad result is inevitable. A number of our foresters and nurserymen have steadfastly set their minds to overcoming the obstacles that prevent the production of the ideal nursery plant. To that end Mr A. Murray, head forester, Murthly, has devoted much thought and time. He has made and tried numerous experimental transplanting laths, and finally has invented a machine that is simple, practical, and effective in its working.

Mr Murray's "transplanting laths" consist of two straps of wood, $2\frac{1}{2}$ inches by $\frac{1}{2}$ inch, placed on the soil surface $2\frac{1}{2}$ inches apart. At right angles to these straps a face-board, $4\frac{1}{2}$ inches by $\frac{5}{8}$ inch, is fixed, the three pieces being firmly held together by several light wooden brackets. On the front of the perpendicular face-board a number of buttons and stops are fixed. The buttons hold the plants firmly in position, and are fastened to the face-board by either brass screws and cups or ordinary screws and spring washers.

On the top of the face-board, and behind the projecting ends of the buttons, a sliding rod is fitted. This rod can be moved sideways by a lever, and carries a series of iron pegs which work against similar iron pegs on the corresponding buttons. Thus the whole of the buttons can be simultaneously opened by a slight movement of the lever.

The filling is exceedingly simple, and is generally done by young girls or boys. The lath is lifted from the nursery line, the buttons being all open. It is laid on its side on anything

FIG. 1. Filling the Transplanting Lath.

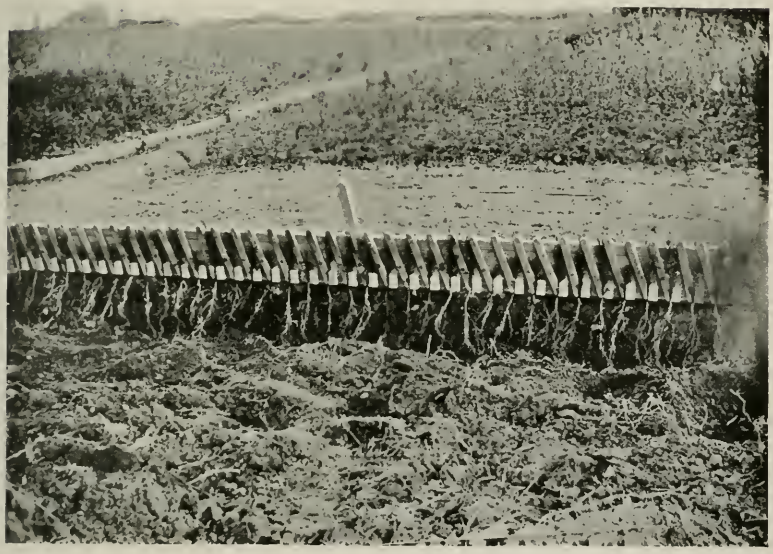

FIG. 2. The filled Lath in Position.

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of a convenient height, the face-board now being in a horizontal position. A plant is placed between the button and its stop, and the button closed by a touch of the finger. This operation can be performed very quickly, and any size or shape or species of plant can be instantly, firmly, and yet gently locked in position, and no amount of wind or jarring can in any way displace it.

The laths when filled are placed in position over the open trench, which latter must be of sufficient depth to enable the roots to hang vertically and clear of the bottom. Any defect either in the shape of the trench or the position of the plant can now be instantly detected, as the whole of the plant is clearly visible. The soil removed in opening the trench is then replaced and lightly trodden, the lever moved (when all the plants are freely released) and the lath taken to be refilled.

The laths are made in lengths of 8 to 10 feet, and the buttons arranged to hold the plants at intervals of $2\frac{1}{4}$ inches or sixteen plants to the linear yard, but any division can be made.

Besides the obvious advantage of obtaining a good root-system, this new lath has the following advantages :—

1. The number of plants that can be transplanted is more than double that which can be done by the hand system.

2. The plants are in no way damaged by the lath, neither have they to be of a uniform shape or size.

3. Transplanting is not in any way dependent upon weather conditions, wind, etc., as sometimes is the case with other types of lath.

22. Forestry Work by Boy Scouts and Schoolboys.

In a considerable number of cases now parties of schoolboys and scouts have carried on work in connection with forestry during school vacations, and the result has been to show the value of their services. Among such working-parties may be mentioned that contributed by the Kelso boy scouts during the Easter holiday of this year, and the Scottish Schoolboys' Camp at Murthly.

A short account of the work of the Kelso boy scouts was contributed to the *Kelso Mail* for 2nd May last, and indicates its scope very clearly. It is as follows:—

"During the Easter holidays the Kelso boy scouts determined to show their patriotism and usefulness by doing some war work. Forestry was considered the most suitable for us, and getting into touch with Mr Leven, Bowmont Forest, we agreed to do three weeks' work in the nursery or in planting-out trees. The accommodation at the forest being somewhat limited, we could not all go at once, but divided ourselves into two squads. Five scouts and the scoutmaster went the first week, and the remaining five the two following weeks. Our accommodation consisted of a small room, in which we cooked and took our meals, and three bedrooms in a separate building. Mr Leven saw to it that we had abundance of fuel, while we provided our own food and did part of the cooking. Two orderlies were told off each day to cook, wash, and clean up. Plenty of good milk was obtained from Softlaw Farm. We had four meals per day—breakfast at 6.30, dinner at 12, tea at 5, and supper (generally porridge) at 8. All went to bed at 9.30.

"The first week proved disastrous. On Monday the 9th we were conveyed to our abode and got settled down by night. On Tuesday morning we were out at 7, but, alas! it was bitterly cold—colder we thought than ever we had felt before. We turned out to the plantation and set to work. As no planting could be done we were put to fill in sods at the foot of a piece of wire-netting that enclosed a space to be planted. We worked away at this manfully till the afternoon, when showers of snow compelled us to retire. Next day, Wednesday, we could not go out on account of the drift, and on Thursday we saw it was

useless to stay any longer in these conditions, so we departed for Kelso.

"The second squad came up on Tuesday of the following week. For two days the weather was still unpropitious. But it gradually improved, and on the third week it was almost ideal. After doing some fencing, we got to real forestry work, *i.e.* planting out four-year-old Scots pines. The method of procedure was as follows—the squad of six men went along and each made a slit like the letter L, raising up the sod into which a boy inserted a tree, and heeled it tightly round. One boy could attend two men easily, whilst some carried the trees. It was surprising how quickly the trees could be planted by this method. They were planted in rows three feet apart, each tree three feet from its neighbour.

"Another method of planting is by pitting the trees. This is adopted where the ground is full of the roots of the trees that have been cut down, or when the trees are too big and old to be put in by slitting. A hole about a foot square is dug out—not an easy job sometimes. Into one of the corners a five-year-old Scots pine is placed, and the loose earth, and finally the sod, placed around it. The scouts, following the men who made the pits, planted the trees. At this we soon became quite expert.

"We then did a little beating up, as it is called, *i.e.* planting a tree in the place of one that had died, or beside one which was rather delicate and sickly. By slitting and pitting we reckoned we had planted 20,000 trees, calculating about 4000 trees to the acre. The number of trees that can be filled into a little space absolutely surprised us.

"Our last job was in the nursery. Here a high degree of skill and care is required; but we soon proved equal to the occasion, and were of great assistance. A bed of two-year-old larch had to be planted out. One man dug the plants out of the seed-bed and graded them into first and second qualities. The other six men set to work on a piece of fine loamy ground. The soil must be of the nature of that used for moulding, *i.e.* must stand up well when cut through with a spade. An almost vertical trench about 9 inches deep was cut out, and against the side of this the young larches were placed between 3 and 4 inches apart. They were held in position with a handful of soil. Whilst the boys were doing this the men followed

digging another trench and filling in the earth against the planted trees. This being carefully levelled to a line the next row was proceeded with. In two days we transplanted about 20,000 larches.

"As an experiment the holiday was eminently successful. The boys got some idea of what forestry is, and maybe one or two may be tempted to leave town and take to work in the woods. A healthier life could not be desired. Our country wants men on the land. If boys acquire a taste for such work as this they will go to the land without much persuasion. Experimental work like this ought to be encouraged; and we are all very grateful to Mr Leven for carrying the matter through. The scouts benefited in many ways. They got an insight into woods and trees which could not be gained otherwise, for an ounce of practice is worth a pound of theory. Most of the boys now can tell a Scots pine, Sitka spruce, silver fir, Austrian pine, etc. Their health improved greatly. From seven till five in the open woods at hard work gave us such an enormous appetite, that we found it impossible to live on rations, so we just ate till we were satisfied. Great interest was evinced in natural history, and we were fast becoming expert entomologists. The scouts were continually finding something new, and as we carried a stock of boxes and bottles we had a collection every night. Centipedes and millipedes were discovered under sods; one or two pine beetles were found in broken pine twigs; a few pine weevil larvæ were dug up from the roots of a pine; a curious beetle (*Rhagium*) and its larva were excavated out of an old rotten tree in which they lived, along with several large beetles, and other insects.

"The Easter holiday of 1917 will remain long in our memories, and, doubtless, in the years to come some of us will visit the forest to see the progress of the trees we planted. Then the truth of the motto of the Royal Scottish Arboricultural Society will come home to us—'Ye may be aye sticking in a tree; it will be growing when ye're sleeping.'"

In a later issue of the same newspaper, Mr George Leven, in a letter to the editor, expressed the opinion that the services of the boy scouts were of "real value." He goes on to say:—

"Schoolboy labour has been made use of to a certain extent

in farming, forestry, and other country work since the war began to tell on the supply of adult labour, but it is not by any means a new development, as 25 to 30 years ago boys and girls used to get permission to leave school, for a few weeks in early spring, to assist in planting trees, etc., on large, wooded estates. The actual insertion of a plant into the soil is a simple operation in itself, but, like most simple operations, there is a 'knack' in it, and it is marvellous how quickly the unbiassed hand of youth acquires this.

"The short experience we had of the scouts here showed they were able to undertake various kinds of work, if shown in practice how to act and a little oversight exercised. Most of them could make a very fair show with a spade, and while prolonged spells of hard work might have been too much for their soft muscles, they seemed never to be more than healthily tired. The boys were probably in a more than fortunate position, as their scoutmaster is in the unique position of holding a certificate in forestry of the Highland and Agricultural Society. His wide knowledge of nature and science he placed at the call of his boys, and infused not a little of his enthusiasm into them."

Mr Stanley Nairne, the Camp Commandant, has kindly supplied the following account of the camp at Murthly :—

"For the past five years large numbers of the older boys, belonging to the Secondary schools of Edinburgh and Glasgow, have attended the Scottish schoolboys' camps which have had a religious aim in view. This year the proposal was made that five hours of each day be spent in forestry work, and by arrangement with Colonel Fothringham of Murthly, the boys settled down on 5th April at Kingswood, Murthly. A hundred and fifty Glasgow boys were at camp from 5th to 16th April, and on the latter date their place was taken by a hundred and fifty Edinburgh boys, who stayed to the end of the month. The boys paraded for work at 9.30 each morning, and were engaged in the woods till about 3.30, when they returned to dinner. The rest of the evening was given up to sports, sing-songs, and the short evening service which has always been one of the characteristics of these camps.

"The work was supervised by Mr Murray, the forester, whose interest in the work and appreciation of the boys' helpfulness

was a very important factor in the success of the camp. To him we are indebted for the following notes regarding the work done :—

'The boys' work consisted partly in burning branches and other refuse from ground recently cleared of timber for national purposes. The branches were first gathered in heaps and then set on fire, care being taken that the fires did not spread to the adjoining plantations. As the old tree roots provide a breeding-ground for an injurious insect (*Hylobius abietis*), a number of the boys were also employed in stripping the bark off these with iron bars, and thus destroying the weevils' breeding-ground. By this means it is expected that the ground can be replanted at an earlier date, instead of its waiting four to five years to allow the weevil to run its course, besides the risk of spreading the insects to other plantations.

'During the camping period planting and nursery work was in full operation on the estate, and a number of the older boys were employed in this work. A small plantation of pure *Douglasii*, with a margin of beech, was formed entirely by the boys, and it is hoped will do them credit. The planting was done with the semicircular spade, and was skilfully carried out. The boys also planted a number of ornamental shrubs and conifers, and a part of a plantation consisting of *Tsuga Albertiana*.

'The nursery work included the lifting of tree plants preparatory to their being placed in the woods by the estate workmen, also the lifting and selecting of plants from the seed-beds, while the boys assisted in digging the ground, and transplanting these in the usual line form. Transplanting laths were provided, and the smaller boys were adepts at filling and placing these on the opened track. The estate men and several of the older boys were thus able to go on digging continuously, and in this way a very large number of tree plants were transplanted. A considerable amount of heather burning, under the guidance of the gamekeeper, was also done, this being necessary for the production of young heather, which serves as food for grouse and sheep. Tree felling in a wood recently purchased by the H.G.T. committee was also performed, and as a number of the boys were not amateurs at this work, a large number of trees were soon laid low; these were afterwards stripped of

their side-branches and cross-cut to their respective lengths. Several boys were employed in the collection of Scots fir cones. The crop for the season was a poor one, yet several large bags were filled.

'During the period a great deal of important work was done by the boys, and had the weather conditions been more favourable, no doubt they would have given a still better account of themselves.'

"It is hoped that this experiment may be tried again on a still more extensive scale. It is now proved that these boys can do valuable work, and the securing of their interest in forestry is a national asset that cannot fail to be of use in the future."

NOTES AND QUERIES.

The Great War.

The Society's Roll of Honour.

Fifth List.[1]

Aitken, George, Foreman Forester, Culter House. Seaforth Highlanders.

Allan, John C., Assistant Forester, Mellerstain. K.O.S.B.

Anderson, J. A., Assistant Forester, Dunphail.

Bruce, C. R., Forester, Cornbury Park Estate, Oxon. Sapper, Artisan Works Co., R.E.

Cameron, Robert, Forester, Brinscall, Chorley.

Christie, James Sinton, Superintendent of Parks, Camberwell, London. 1/21st London Regiment.

Fraser, Geo. K., Stonehaven. Pioneer Special Brigade, R.E.

Haldane, David, Forester, Dalmeny. Forestry Corps, R.E.

Hepburn, R. G., Culzean Gardens.

Hutton, G., Assistant Forester, Castle Kennedy. H.L.I.

Lauriston, J., Forester, Longdon Heath, Worcestershire. Lance-Corporal, Labour Bn., D.C.L.I.

Lindsay, Hugh, Forester, Torwoodlee. Gunner, R.G.A.

MacArthur, Alaster, Inveraray. Captain, 8th A. & S. Highlanders. (Killed.)

Middleton, James, Assistant Forester, Blythswood. Signaller, 3rd K.O.S.B.

Ritchie, M. A., Assistant Forester, Dalwhinnie. Gunner, R.G.A.

Shield, Geo. R., Estate Office, Newtyle. Sub.-Lieut., R.N.V.R.

Wilson, James, Assistant Forester, Fordel, Glenfarg. Gunner, R.G.A.

Wilson, Dr Malcolm, Edinburgh. Lieutenant, Sanitary Section.

Whyte, John D. B., Newton, Wormit. Captain, R.E.S.

Young, Peter, Assistant Forester, Chapelhill, Methven.

[1] For First, Second, Third, and Fourth Lists see Vol. xxix. p. 192. Vol. xxx. pp. 47 and 129, and Vol. xxxi. p. 66, respectively.

Forestry and Schoolboys.

A considerable amount of really useful work has been done in forestry by schoolboys during the past year (cf. p. 162). As experience has been gained, the enthusiasm of the volunteers and the efficiency of their work has increased. There is in forestry an almost unlimited amount of useful and urgent work to be done at the present time. Many kinds of this work can be done by boys, and there is practically no operation, no matter how heavy or skilled the nature of the work may be, in which they cannot, at least, render valuable assistance. Boys take readily to work in the forest, and enjoy it thoroughly; it would, further, be difficult to find a more healthful and congenial environment for them than the forest. After a few lessons they very soon acquire the necessary proficiency in the work, whether it be felling, snedding, and cross-cutting timber, or planting young trees, or any of the varied forms of nursery work which require manipulation, skill and dexterity. After a few lessons or demonstrations by a skilled forester, a small amount of oversight and guidance is all that remains necessary to ensure that their labour is used to the best advantage. The employment of schoolboys, also, cannot fail to be productive of useful results from an educational point of view. One has only to think how few of the present generation have the faintest notion of what forestry really means to a country. The war has demonstrated, in such a way as nothing else could have done, that an adequate timber reserve is of vital importance; but how many people are aware of the amount of labour and skill which was necessary to produce our present woods, such as they are? A great many people seem to imagine that our forests, like say our coal mines, have been produced by nature, ready for exploitation by man. While there is a certain amount of justification for this conception, the fact is entirely overlooked that the natural reserves in coal are strictly limited to what nature has already provided, but the forest will continue to yield timber, in ever-increasing volume, for all time to come, in direct proportion to the skill and intelligence exercised in the exploitation of its resources.

The trees which are now being cut must be replaced as soon as possible, otherwise the denuded areas will suffer from soil

deterioration, and their productive capacity will be lowered. We must also replace our timber stocks, and increase them by the planting of new ground to as great an extent as possible. We are faced with the problem of developing forestry as an important national industry on a scientific and economic basis, and in view of the serious extent to which our timber resources will be depleted at the end of the war, we can afford to lose no time in getting to work. Nevertheless, for the sake of the future, what better beginning can be made at the present time, than to train and interest as large a number of the rising generation in forestry as possible?

Our lack of appreciation of what forestry means to our country, in the past, has led to its neglect. Let us, therefore, hope that an extended knowledge of what forestry really is, and what it means to any country, will lend support to the development of an industry so vital and essential, and that by making every effort to interest young people in forestry we may ensure that the rising generation will have a clearer perception of the almost unlimited scope and advantage of a sound policy of forest conservation. HON. ED.

TIMBER TRANSPORT.

(With Plate.)

In the autumn of 1916, about 500 Scots pine trees of an average size of 26 cubic feet were sold standing, by the writer, in a long narrow plantation extending to a length of nearly two miles.

Unfortunately, owing to the conformation of the ground, it was only possible to remove the timber by taking it all to one end of the plantation in order to get it loaded near a hard road, and, as it had to be transported over a soft bottom, and across some long, deep gullies, it was not practicable to remove it by horse haulage. It was, therefore, decided to lay a tramway line nearly the whole length of the wood, and this was done by securing a quantity of the light rails usually employed in coal pits, *i.e.* rails 12 feet long, weighing 18 lbs. per running yard. These were fixed to light fir sleepers, 3 ft. × 5 ins. × 2 ins., and carted to the ground, where they were placed in position by a couple of

FIG. 1. Side view of trestle bridge.

FIG. 2. Surface view of trestle bridge.

FIG. 3. Timber trolly at terminus of line.

[*To face p.* 170.

workmen who laid a large quantity per day. Special sleepers and curved rails were laid at the bends in the track, the rail on the outside of these being slightly raised, so that the loaded trollies might take the curve easily. The gullies were negotiated by building bridges of planks and trestles (see Plate V. Figs. 1 and 2), the first trestle being the shortest, and each succeeding trestle a foot or so taller, until the deepest part of the gully was passed, when the difference in size became reversed. Planks were laid over the trestles, and the lines laid over these. The trestles were laid on broad boards to prevent them sinking into the soft ground, and the whole structure answered its purpose admirably, standing as sound and firm after the timber was removed, as it did when first erected.

Light four-wheeled trollies (Fig. 3) were used, capable of bearing a load of two tons, and were drawn by a pony on the level and up-grades. The inclines, where not too steep, were managed by simply letting the trolly and load go down by its own weight. On the steep down-grades, of which there were only two, one of the wheels was fixed by inserting a "sprag," or piece of wood or iron, between the spokes, thereby locking the wheel. It could then be safely drawn down by the pony.

The trees were drawn in sledges from either side of the plantation, close to the tram line, where they were loaded on the trolly. A strong flat-bottomed sledge with oak runners was first used, but later on a new form was introduced having the runners shod with $\frac{1}{4}$-inch iron, which was continued upwards and inwards to more or less of a point, somewhat resembling the bow of a boat, the width of the sledge being 3 feet. This was found a distinct improvement, as it became quite easy to draw a fully-loaded sledge out and in among the standing trees, over stumps, boulders, and other obstacles. The sledge glided easily over and past all obstructions, and its construction reduced the strain on the horse. The whole plant worked wonderfully well, was quickly laid, enabled the timber to be cheaply and effectively removed, and was quickly taken up again, to be stored away for future use. At a time like the present, when so much timber is being cut and removed over difficult ground, a more extensive use might be made of the simple contrivance described here, and this would help to reduce working expenses and to check waste of material.

GEO. MOWAT.

Over-Ripe and Dying Trees.

The disadvantages of leaving over-ripe and half-decayed trees standing in hedgerows and plantations are many. In the first place they are an eyesore, and spoil the amenity of the place; they are constantly shedding their branches and so littering the ground under them, which is a serious consideration if the ground happens to be agricultural land. It is a waste of good timber, and consequently a waste of money, to let a good tree stand until it decays. It provides undesirable insect pests with a first-class breeding-ground, helps the growth of fungus disease, and in many ways spreads disease and infection over a wide area. In time these trees break off or are blown over and cause far more damage to hedges, fences, or young growing trees, than if they had been felled at the proper time, and sold for their proper value.

Geo. Mowat.

Particulars of Form-Factors worked out for Corsican Pine and Larch.

Figures for trees measured up to 26th February 1917.

	Corsican Pine	Larch
Age	35 years	35 years
Number of poles per acre	540 of all sorts (300 larch, 200 Corsican pine and Scots pine, 40 hardwoods)	
Trees measured	150	120
Smallest $\frac{1}{4}$-girth measured at 4 ft. 3 ins.	6 ins.	4 ins.
Diameter at top of pole	about 3 ins.	about $2\frac{1}{2}$ ins.
Average height of trees	45 feet	44 feet
Form-factor for all trees measured, carried to third decimal figure	·476	·483
Extreme form-factors for individual trees	·593 and ·400	·585 and ·425

Figures for trees measured up to 1st April 1917.

	Corsican Pine	Larch
Trees measured	297	250
Average height	$45\frac{1}{2}$ ft.	$44\frac{1}{2}$ ft. (nearly)
Form-factor for all trees	·469	·474
Extreme form-factors	·593 and ·400	·592 and ·425

Figures for trees measured up to 19th April 1917.

	Corsican Pine	Larch
Trees measured . . .	400	350
Average height . . .	45·3 feet	44·2 feet
Form-factor for all trees . .	·477	·475
Extreme form-factors . .	·593 and ·400	·592 and ·413

The following was the method employed in arriving at figures:—

Each pole was measured for full length
Each pole was girthed at 4 ft. 3 ins. from butt end } to arrive at contents of true cylinder by square of $\frac{1}{4}$-girth calculation.

Each pole was measured to end of timber
Each pole was girthed at half-way } to find contents of tree by square of $\frac{1}{4}$-girth calculation.

The contents of each tree, in inches, were divided by the contents of a true cylinder based on the $\frac{1}{4}$-girth at 4 ft. 3 ins. of each tree.

Example.

Tree 50 ft. in height × 8½ ins. ¼-girth at 4 ft. 3 ins.
Contents of cylinder = 25 ft.
Contents of tree to timber-height 40 ft. × 6½ ins. ¼-girth = 11 ft. 8 ins.

25 ft. = 300 ins. 11 ft. 8 ins. = 140 ins.

$$\frac{140}{300} = \cdot46\dot{6}, \text{ or say } \cdot47.$$

All form-factors for each species were added together and divided by the total number of poles of that species.

The reason for the reduced form-factors in the second list is, that the additional trees were measured where the height-growth was slightly better, but the trees being more drawn up, the top of the "timber" was brought proportionately lower, or, in other words, a longer length of top was cut off.

W. H. Whellens.

OBITUARY.

The Late James Kay.

By the death of Mr James Kay, who passed peacefully away on the 3rd of April last at the age of eighty-two years, the Society has lost one of its oldest and, for many years, one of its most active members. Mr Kay joined the Society in 1867, and therefore had completed the fiftieth year of his membership. On the occasion of the Jubilee Anniversary, in 1904, six members of the Society were elected honorary members "in consideration of their services to Forestry in Scotland, and in honour of the Society's Jubilee," and, along with the late Mr John Grant Thomson and the late Mr D. F. Mackenzie, Mr Kay was selected for the honour from among the practical forester members. On the honorary members elected on that occasion, however, the hand of death has been laid heavily, and it is sad to relate that, by the passing away of Mr Kay, Professor Somerville is left the sole survivor of the group.

Mr Kay was born on the Duke of Hamilton's estate, in Lanarkshire, on 21st March 1836, and he received his early training in forestry there. He afterwards became forester on the Lee and Carnwath estates of the late Sir Norman Lockhart, Bart., in the same county. Leaving Lee, after five years' service, with a very excellent testimonial from the then resident factor, Mr John Hosack, he entered the employment of the late Marquis of Bute as head forester in 1864, in succession to the late Mr Thomson, and for forty-seven years he had the management of the woods in Bute and the neighbouring island of Cumbrae. He retired from active service in the end of 1910, and as he continued, with Lord Bute's permission, to reside at Barone in his retirement, he occupied the same dwelling for over half a century.

In the earlier years of his membership, Mr Kay contributed a number of articles to the *Transactions* of the Society. These include papers on "Beech and Thorn Hedges" (Vol. iv. p. 187), "Wire-fencing with Wrought-Iron Standards in Stone" (Vol. v. p. 79), "Register for Foresters" (Vol. v. p. 155), "Geology and Arboriculture of Bute" (Vol. vii. p. 60), "Old and Remarkable

Trees in Bute" (Vol. ix. p. 73), and various notes. Of an inventive turn of mind, Mr Kay also devised some useful mechanical and other appliances for use in forestry, and of these there may be mentioned the following, which are figured and described in the *Transactions*:—"Instrument for Measuring Heights of Trees" (Vol. v. p. 170), "Measuring Angles or Boundary Lines of Plantations, etc." (Vol. vi. p. 338), "Transplanting Machine" (Vol. vii. p. 186), and "New Straining Pillar for Wire Fences" (Vol. x. p. 32).

As the years of his greatest activity belonged to a period when it may be said that arboriculture, and not silviculture, held sway in this country, most of those who were not intimately acquainted with Mr Kay probably formed the opinion that he belonged to what has been not inaptly designated the "old school" of Scottish foresters. This, however, was not so. It is true that, like most young men of his day, in the early period of his career Mr Kay had no opportunity to acquire a knowledge of scientific silviculture such as the young forester of the present day enjoys; but, like many more of the foresters of a past generation, he knew how to grow good timber, a fact to which the plantations he has left behind him bear witness. They prove also that the observant practical forester, if he weighs up the pros and cons of the matter carefully, can acquire a better knowledge of real silviculture in the course of his everyday work than many can do from the teacher of it behind the class-room platform. In forestry, as in most other things, Mr Kay had an open mind. He was not, by any means, the least enthusiastic of the small band which went, under the leadership of Professor Somerville, to Germany in 1895 in order to see for themselves what was the real state of affairs at the very fountain-head of scientific silviculture, and he came back, like a number of the others, impressed with its perfection. But, knowing the climatic conditions of his native country so well, he was quite convinced that the silviculture which he saw in Germany, and which he saw subsequently in France, could not be adapted to this country as it stood; that, in fact, it would require to be considerably modified to suit our insular conditions, and there can be no doubt that in this he was right.

It only remains to be said that in private life Mr Kay was one of the most likeable of men. Shy to a degree and

unassuming, he nevertheless possessed a considerable fund of humour, and to those who knew him well he was one of the most delightful of companions.

Mr Kay is survived by Mrs Kay and by a family of one son and three daughters. His son, Mr Thomas Girdwood Kay, is an engineer, and is engaged in the high explosives department of the Government.

A. D. R.

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON:

HIS MOST GRACIOUS MAJESTY THE KING.

PROCEEDINGS IN 1916.—*Continued.*

THE GENERAL MEETING.

The General Meeting of the Society was held in the Goold Hall, 5 St Andrew Square, Edinburgh, on Wednesday, 12th July 1916, at 2.30 P.M. Sir ANDREW AGNEW, Bart. of Lochnaw, President of the Society, was in the Chair.

MINUTES.

The CHAIRMAN said that the Minutes of the Annual Meeting, held on 5th February last, were in print on the table and asked if the meeting desired them to be read. It was agreed that they should be held as read, and they were accordingly adopted.

APOLOGIES.

Apologies for absence were intimated from Sir John Stirling-Maxwell, Colonel Steuart Fothringham of Murthly, Sir John Dewar, Sir Hugh Shaw Stewart, Captain Sprot of Riddell, Sir Arthur Mackenzie of Coul; Messrs Gordon, Curr and Howe, Members of Council; and Messrs J. A. Alexander, D. A. MacCorquodale, John M'Kerchar, and William Wilson.

CHAIRMAN'S REMARKS.

The CHAIRMAN then delivered an address dealing with the position of the afforestation question at the present time. (A full report of this address appears in the *Transactions*, page 1.)

Judges' Report on Essays.

The Secretary reported that *six* essays had been received and submitted to the Judges for consideration, and that their awards were as follows :—

1. "A System of Double Entry Book-keeping suitable for large Estate Woodlands." By Harry Watson, Assistant Forester, Darnaway Forest, Forres. Award—No. 2 Silver Medal.
2. "Afforestation of the Scottish Highlands." By Alexander M'Pherson, Head Forester, Poltalloch, Argyll. Award—Bronze Medal.
3. "Corrimony Fencing." By Alexander M'Pherson, Head Forester, Poltalloch, Argyll. Award—Bronze Medal.
4. "Larch." By Alexander M'Pherson, Head Forester, Poltalloch, Argyll. Award—No. 3 Silver Medal.
5. "Growth of a Tree." By F. No Award.
6. "Nurseries." By S. No Award.

Action of Reduction and Declarator by Mr C. S. France against the Society.

The Secretary explained that this was an action raised by Mr France to have the new Rule XIV., which regulates the election and term of service of the Council, set aside and the old Rule XIV. declared to be still in force, on the ground that the new rule submitted for adoption at the Annual Meeting in February 1915 had not been passed in terms of Rule XXI. He said that this matter had been the subject of correspondence between Mr France and himself and the Hon. Secretary, and that Mr France, not being satisfied, had taken this means to endeavour to have his view given effect to. The Council were satisfied that the proceedings observed in passing the rule were in order, and they were accordingly defending the action.

Conference with Scottish M.P.'s.

The Secretary read a report of the Deputation to the Scottish Members of Parliament, held in the House of Commons on Tuesday, 4th July, which had already been referred to in the President's address. (This report appears in the *Transactions*, page 20.)

Afforestation of Privately owned Land.

The Secretary read the correspondence with the Development Commissioners on this subject, and explained that the Commissioners had agreed in principle to the payment of the present rent of the land proposed to be leased, and to a bonus on the ultimate profits. The correspondence also contained references to proposed measures for preventing or controlling damage by rabbits and insect pests. Mr Leven drew attention to the danger which might arise from the latter source in connection with the extensive cutting of timber at the present time, because of the considerable amount of brush which might be left for an indefinite time on the ground. He urged that the cleaning up of this brush should be attended to as early as possible, so as to prevent the breeding of insects.

Employment in Forestry for (*a*) Discharged Disabled Soldiers, etc., and (*b*) Soldiers and Sailors Returning after the War.

The Chairman mentioned that this subject had been put down on the Agenda to enable members to express their views on these topics. He said that the Middle Ward of Lanark were endeavouring to make arrangements for assisting in this way in connection with their afforestation schemes at Hairmyres and Camps, and he hoped that every landowner and employer would help as far as they could.

Our Home Woods and National Requirements of Timber.

The Chairman explained that this question had been before the Council on several occasions, and had been discussed with the Board of Agriculture. The great difficulty in carrying out a survey of the standing timber in the country was the want of men to undertake this duty owing to the pressure of other work in the meantime.

Death Duties.

The Secretary mentioned that he had had correspondence with the Estate Duty Department on this subject, and that the Department had now agreed that the deductions to be allowed in respect of "necessary outgoings" would be held to include

management expenses necessary to maintain the woods in the condition in which they existed at the death, such as the wages of foresters and woodmen, cost of pruning and cleaning, of fencing for protection, and of the killing of vermin, and outlays for seeds and plants, and the upkeep of a nursery. He said that this reply was so far very satisfactory, but added that occupiers' rates and taxes and rent, if actually paid, should also be included as necessary outgoings payable by the occupier.

Income Tax on Woodlands.

The Secretary mentioned that at the instigation of Mr Milne-Home and himself, Mr MacCallum Scott, M.P., had moved an amendment to the Finance Bill in the House with the view of having this subject further discussed, and that he had attended a Conference with several M.P.'s and others in the offices of the Central Land Association, London. It was mentioned at this meeting that in the course of the discussion in the House it was evident that the authorities were willing to do something to encourage afforestation, and were open to receive suggestions. The matter was fully discussed, and was remitted to several M.P.'s who undertook to see the Treasury and endeavour to arrange some concession which would be an encouragement to landowners to plant.

Proposed Excursions.

The Chairman mentioned that the Council had agreed to endeavour to arrange for two one-day Excursions—one to be held in the south and the other in the north of Scotland—to permit members of the Society to study the methods of Canadian lumbermen who were engaged in cutting down timber in our woods. It was proposed that a slip should be attached to the *Transactions*, making this announcement and inviting members who wish to take part to send their names to the Secretary so that he might forward particulars as soon as they were ready.

Forestry and Young People.

A letter was read from Mr Andrew Hamilton, 9 Denman Drive, Liverpool, a member of the Society, drawing attention to the need of endeavouring to interest young people in forestry,

and suggesting that a fund might be instituted for the purpose of providing prizes to country schools who do the most tree-planting each year, and intimating that he and his friend, Mr William Rowan Thomson, Engineer, Glasgow, were willing to contribute between them £50 as a beginning of such a fund, the interest or principal of which might be used as thought best by the Council of the Society. The Secretary mentioned that Mr Hamilton had called upon him and had further explained his views, and had expressed the willingness of himself and Mr Thomson that this money should be applied in any way the Council thought would be most advantageous in interesting young people in forestry. The Secretary intimated that the Council had cordially accepted the offer, and had appointed a Committee to consider and report upon the proposals.

Collection of Medicinal Plants.

Mr Gayer, from Messrs Duncan, Flockhart & Co., Manufacturing Chemists, then addressed the meeting on the value of the rhizome of the male fern for manufacturing purposes, and said that he would be glad if any members who would undertake the collection of this root would communicate with him on the subject. He explained that before the war the preparation obtained from this rhizome was almost entirely manufactured in Germany, and it was necessary that this product should now be manufactured in this country. He explained that from 100 to 200 tons of the root was required this season by his firm, who were hopeful that they would have the sympathetic co-operation of the estate owners in finding this supply. It was mentioned that the price of the moist root was from £6 to £6, 10s. per ton on rail.

Mr Murray, Forester, Murthly, said that he had supplied a quantity of the root which had produced 35 per cent. of profit, so that it was worth while taking the matter up.

Notice of Motion.

The Secretary intimated that he had received from Mr Charles S. France notice of the following Motion to be proposed by him at next Annual Meeting :—

"That Rule XIV. of 1908 be altered to read as follows :—

"That the affairs of the Society shall be conducted by a

President, six Vice-Presidents, and twenty-four Councillors, with Secretary and Treasurer and Auditor; provided always that nothing herein contained shall prevent the same person being appointed both Secretary and Treasurer. The President, two Senior Vice-Presidents, eight Senior Councillors, Secretary and Treasurer and Auditor shall retire annually: but the President, Secretary, Treasurer and Auditor shall be eligible for re-election. One of the retiring Vice-Presidents or one of the retiring Councillors may be elected as President, and one of the retiring Councillors may be elected as Vice-President, but the retiring Vice-Presidents or Councillors shall not be eligible for re-election to the same office till after the expiry of one year. The vacancies to be filled by the election of eligible members representative of the different districts of the country, in manner following:—Scotland to be divided into eight districts, the same as the Show districts of the Highland and Agricultural Society, and each district shall annually elect a member resident in each district as representative thereof."

The CHAIRMAN pointed out that as Rule XIV. of 1908 no longer existed, the notice now given was irrelevant in the circumstances, and that the Motion would not be competent unless Mr France succeeded in his Action of Reduction and Declarator mentioned above.

A vote of thanks to the Chairman closed the proceedings.

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON:

HIS MOST GRACIOUS MAJESTY THE KING.

PROCEEDINGS IN 1917.

THE ANNUAL MEETING.

The Sixty-fourth Annual Business Meeting of the Society was held in the Goold Hall, 5 St Andrew Square, Edinburgh, on Wednesday, 7th February 1917, at 12.45 P.M., and was attended by about fifty members. Sir ANDREW AGNEW, Bart., President of the Society, was Chairman.

APOLOGIES.

The SECRETARY intimated that he had received apologies for absence from Mr Sutherland, of the Board of Agriculture, and Colonel MacDougall, Director of the Timber Operations of the Canadian Overseas Forestry Corps, who had both been unexpectedly detained in London on urgent business and would be unable to be present at the meeting.

Apologies for absence were also intimated from Sir John Stirling-Maxwell, Hon. Secretary, Lord Forteviot, Lieut.-Col. Steuart Fothringham, Sir Arthur Mackenzie of Coul, Professor Hendrick, and Messrs D. T. Samson, John Boyd, Donald Munro, H. Boyd Watt, John M'Kerchar, A. J. Munro, W. H. Massie, G. P. Gordon, J. A. Howe, Charles W. Ralston, and C. S. France.

MINUTES.

The CHAIRMAN mentioned that the Minutes of the General Meeting, held in July last, were in print on the table and asked whether the meeting desired the Minutes to be read. It was agreed that they should be held as read, and they were accordingly adopted.

Report by the Council.

The Secretary then read the Council's Report as follows:—

Roll of Honour.

The third and fourth lists of the Roll of Honour were published in the last two issues of the *Transactions*. The two previous lists contained 181 names, and the third and fourth lists contain 51 names, making a total of 232. It is not likely that all fatal casualties that have happened have been recorded, but we regret to say that the following are amongst the killed:—Captain R. F. Balfour, Younger of Balbirnie; 2nd Lieut. T. D. Strathern, Whitehaven; 2nd Lieut. Tom Curr, Ninewar; 2nd Lieut. Thomas Hood, Land Agent, Egypt; and Private Andrew Scott, formerly of Keir.

Membership.

The following twenty-five deaths amongst the civilian members have also been recorded:—Mr John Williamson, Loanhead; Lord Addington; Mr George Prentice, late Factor, Kirkcaldy; Mr John Marshall, Timber Merchant, Maybole; Mr James Morrison, Factor, Banff; Mr W. M. Gilbert, *Scotsman* Office, Hon. Associate; Mr James Renton, Factor, Sunbank, Perth; Sir Reginald Gordon Cathcart, Bart. of Cluny; Colonel R. J. Bennett, Ayr; Mr Adam Strachan, Ballechin; Mr Donald M'Lean, late of Dunrobin; Mr Neil Ballingall, Factor, Balbirnie; Mr J. H. Harvie Brown, Dunipace; Miss Yule, Tarradale House, Muir of Ord; Mr William Henderson, Clonad, Tullamore; Mr John Mowat, Hazelhead, Aberdeen; Mr J. P. Robertsonwhite, Advocate, Aberdeen; Robert Drysdale, Novar; Mr George Campbell, Barcaldine, Ledaig; Mrs Macdonald, Swinton; Lord Binning; Sir Charles Dalrymple, Newhailes; the Duke of Atholl; Mr A. B. Innes of Raemoir and Dunnottar; Mr William Kidd, Harwood.

Fifteen members have resigned in the course of the year, and 52 names have had to be removed owing to lapsing and other causes. On the other hand, 59 new members have been elected and the total membership is now 1338, being 38 less than last year.

The Council.

Mr James Grant, Forester, Raith, resigned his seat on the Council upon his removal to Novar, and the vacancy was filled by the election of Mr Robert Allan, Factor, Polkemmet.

Transactions.

The *Transactions* are in course of being issued to all members whose subscriptions were paid last year.

Excursions.

By the courtesy of the Home-grown Timber Committee, the Director of the Canadian Forestry Corps and the proprietors of the lands, members had an opportunity of visiting the Canadian Lumber Camps at Kirkconnel in Dumfriesshire, and at Broadshaw, near Nairn, and of seeing the Canadian methods of lumbering. The members were most cordially received by those in charge of the operations, and given all explanations as to the methods employed. The Council had hoped that the meeting to-day would have been honoured by the presence of Colonel MacDougall, Director of the Timber Operations of the Canadian Overseas Forestry Corps, but, unfortunately, as you have heard, he has been prevented from attending owing to urgent business elsewhere.

Essays.

Six essays were received in competition and were remitted to the Judges for consideration. One of these received a No. 2 Silver Medal, one a No. 3, and two Bronze medals;—the remaining two receiving no award. Members are again reminded that they may write on any subject connected with forestry, but that a list of suggested subjects may be obtained from the Secretary.

Development of Afforestation.

A special meeting of the Council was held on the 8th of March at which the following subjects were discussed, namely (1) The Utilisation of our present Home Timber Supplies; (2) The Restocking of Felled Areas; and (3) The Establishment of State Forests. A report of this discussion was printed on page 91 of Vol. XXX. of the *Transactions*, which was issued in July last. The Resolution, printed on page 100 of the July *Transactions*, on the subject of the creation of a Department of Forestry with an adequate annual grant, to prepare schemes of afforestation combined with small holdings and other home industries, was adopted by the Council at a meeting on 8th April. This Resolution, having appended a statement of facts regarding the present situation, was sent, along with an article by the eminent Scottish architect, Sir Robert Lorimer, on the neglect of Home Timber, to the Prime Minister, the Chancellor of the Exchequer, the Secretary for War, the First Lord of the Admiralty, the Secretary for Scotland, President of the Local Government Board, President of the Board of Trade, the Treasury, the Board of Agriculture for Scotland, the Development Commissioners, and to each of the Scottish Members of Parliament. Subsequently a deputation of the Council was received by the Scottish Members of Parliament in the House of Commons when the question of afforestation was fully discussed. At that meeting the President was able to announce that the Secretary for Scotland had informed him that the Government

were about to appoint a Committee to consider the whole subject and to report to the Reconstruction Committee, which the Government had recently appointed. Lord Lovat, Sir John Stirling-Maxwell, and Mr Sutherland are members of this Committee, and it is understood that their report may be expected soon. The report of the Conference with the Scottish Members of Parliament is printed on page 20 of Vol. XXXI. of the *Transactions*.

Representatives of the Council had also a conference with representatives of the Development Commissioners on the subject of the afforestation of privately-owned lands, and a correspondence subsequently took place between the Secretary and Sir Sainthill Eardley Wilmot, Forestry Adviser to the Commission, part of which was printed on page 108 of Vol. XXX. of the *Transactions* and continued on page 38 of Vol. XXXI. A statement of the financial position of the Development Fund as regards forestry is printed on page 44 of Vol. XXXI.

The Secretary had some correspondence with the Y.M.C.A., the Church Army, and the Salvation Army with the object of getting their help in ascertaining the views of soldiers regarding rural employments on their return from the war. The two latter bodies said that they were quite unable to undertake such an enquiry, but the Y.M.C.A. secretary willingly offered to help, provided a concrete scheme were placed before him which he could recommend to the soldiers. It is impossible, however, to deal further with the matter until the Government's proposals are known.

Conference re *Pit-wood.*

Representatives of the Society also attended a Conference, on 29th March, with the Coal-Mining Organisation Committee on the subject of the supplies and price of pit-wood. Representatives were present from the Coal Owners, the Timber Merchants, and Growers of Timber. The Council's representatives believed that an arrangement would be come to by the various bodies concerned without the need of Government intervention, and this proved to be the case. As the Conference was considered to be private, the Government did not authorise any report to be issued.

Returns of Standing Timber.

As the result of the Conference mentioned above, the Council decided to ask the Board of Agriculture to obtain official returns of all the growing woods in the country, and the requirements of the Coal Owners, Railway Companies, and the Government during the next two years. The matter was brought to the notice of the Board of Agriculture, but in reply it was explained that the great difficulty in carrying out the survey of the standing timber of the country was the want of men to undertake this work owing to the pressure of other duties.

Young Plants and Collection of Seed.

In April the Board of Agriculture suggested that growers of timber should make a special effort to increase the supply of plants for afforestation purposes, and the Council issued a circular to the members of the Society on this subject. The Board, however, did not undertake that the plants so produced would be used.

The question of collecting tree seeds in Scotland, with the view of assisting the Allies on the Continent in re-establishing the trees and woods destroyed by the war, has been under consideration, and will be referred to later in the course of the discussion which is on the programme.

Forestry and Young People.

Two members of the Society, Mr. William Rowan Thomson and Mr Andrew Hamilton, each presented to the Society a sum of £25 to be employed in creating an interest in forestry amongst children. Mr J. L. Gray subsequently sent a similar donation. The Council, after due consideration, decided that the best way to use the money was to write a small book, which should describe the methods of forestry in simple language for young people. The President was good enough to undertake the writing of the book, and it is about to be published at the price of 1s. in paper covers. It is hoped that teachers in country schools may be persuaded to take an interest in the scheme, and to bring the subject to the notice of their pupils. Members of the Society are urged to buy copies of the book, and to make it known to teachers and young people in their neighbourhood. The Council will be glad to receive further donations to the fund, to enable them to extend this very laudable work of arousing public interest in forestry.

Income Tax and Forestry.

This matter was fully referred to at the General Meeting, held in July last, and an article will be found on page 31 of Vol. XXXI. of the *Transactions*.

Death Duties.

This matter was also dealt with at the July meeting. The Council is now glad to be able to say that the Inland Revenue authorities have agreed that occupiers' rates and taxes and rent, if actually paid, shall also be deductable as "necessary outgoings." A note on the subject will be found amongst the "Notes and Queries" on page 72 of Vol. XXXI. of the *Transactions*.

Consumptives and Forestry.

A deputation from the National Health Insurance Commissioners was received by the Council at their October meeting. Dr M'Vail and Dr Leslie Mackenzie explained the proposal of the Commission in regard to the settlement on the land of persons who had been attacked by tuberculosis, and had passed through Sanitoria and been discharged after the disease had either been cured or arrested. The Council assured the deputation of their desire to help in the matter as far as possible, but the question of the provision of suitable accommodation has made it somewhat difficult to give much assistance meantime.

Mr France's Action against the Society.

Proof in this action was heard by Lord Hunter, on 10th and 11th January, and after hearing Counsel for both parties his Lordship at once gave judgment in favour of the Society, finding Mr France liable in expenses.

Scottish Council of Agriculture.

The Society was asked by the promoters of this Council to appoint representatives to serve upon it, and at the meeting of Council of the Society held to-day, it was decided to appoint Mr Gordon and the Secretary.

Dunn Memorial Fund.

There have been no payments in the course of the year, but the usual income has been received.

Library.

The usual list of additions will be appended to the report.

Local Branches.

The reports from the Aberdeen Branch have been received, and will be appended to this report as usual. The Northern Branch is unfortunately in abeyance during the war.

FINANCES.

The Abstract of Accounts for the year ending 31st December 1916, which had been printed and circulated amongst the members previous to the meeting, and also the Accounts in connection with the Dunn Memorial Fund, both of which had

been duly audited, were formally submitted by the Secretary for adoption. Mr M'Hattie, in moving the adoption of the Accounts, said that it was very gratifying that in these times the Society was able to show a credit balance on the year's working. The Accounts were adopted.

Reports from Aberdeen Branch.

The reports were read by the Secretary and, on the motion of Mr Duthie, were adopted. (See Appendix C.)

Election of Office-Bearers.

On the motion of Mr Whitton, Sir Andrew Agnew was re-elected President. On the motion of Mr Leven, the Duke of Buccleuch was elected Vice-President. On the motion of Mr Price, Messrs Spiers, Edinburgh, G. U. Macdonald, Peebles, Robert Forbes, Kennet, George Fraser, Dalzell Estate Office, Motherwell, and Andrew Hamilton, Gardenhall, East Kilbride, were elected Councillors. The Hon. Secretary, the Secretary and Treasurer, the Hon. Editor, the Auditor, the Hon. Consulting Scientists, and the Local Secretaries were all re-elected.

The President returned thanks for his re-election, and moved the adoption of the various reports. He also referred to the prospects of afforestation. (A report of his speech will be found on page 1, Vol. XXXI. of the *Transactions*.)

Dr Borthwick then opened a discussion on "Our Afforestation Problems," which was taken part in by Mr Milne Home, Mr Jones, Mr Cadell of Grange, Mr Allan, Mr Whitton, Mr Leven, Mr Spiers, and Mr Duthie. In the course of the discussion the Secretary read a letter from Colonel Malcolm of Poltalloch, on the subject of the taxation of woodlands. (A full report of Dr Borthwick's remarks and the discussion will be found in the *Transactions*, p. 95).

Mr M'Hattie moved a vote of thanks to the Chairman, which concluded the business.

APPENDIX A.

ABSTRACT OF ACCOUNTS

IN CONNECTION WITH

THE MALCOLM DUNN MEMORIAL FUND, YEAR 1916.

RECEIPTS.

Balance in Bank at close of last Account . .	£3	7	9
Income Tax recovered	0	9	0
Dividend on £100 Redeemable Stock of Edinburgh Corporation, payable at Whitsunday and Martinmas, 1916, £3, *less* Tax, 15s. .	2	5	0
	£6	1	9

PAYMENTS.

Nil.

Balance carried forward, being sum in National Bank of Scotland on Account Current .	£6	1	9

EDINBURGH, 22*nd January* 1917.—Examined and found correct. The Certificate by the Bank of above balance, and Edinburgh Corporation Stock Certificate, have been exhibited.

ALEX. J. MUNRO,
Auditor.

APPENDIX B.

Abstract of Accounts for Year ending 30th December 1916.

I.—CAPITAL.

Balance at close of Accounts made up thus:—			
1. Special Fund *per contra* . . .		£75 0 0	
2. Balance of Revenue carried to next year, subject to payment of cost, etc., of January *Transactions* . . .		478 9 8	
			553 9 8
Note.—Balance of Revenue as above, . . .		£478 9 8	
Less Balance at debit of Capital as above,		157 14 3	
		£320 15 5	
Special Fund as above . . .		75 0 0	
		£395 15 5	
On Deposit Receipt with National Bank of Scotland, Ltd., .	£375 0 0		
At credit of Account current with National Bank of Scotland, Ltd., ...	13 19 0		
In Treasurer's hands, . .	6 16 5		
		£395 15 5	
			£983 17 0

Edinburgh, *23rd January* 1917.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 30th December 1916, of which the above is an Abstract, and have found them correct. The Securities, representing the Funds as above, have also been exhibited to me.

ALEX. J. MUNRO, *Auditor.*

APPENDIX B.

ABSTRACT OF ACCOUNTS for Year ending 30th December 1916.

I.—CAPITAL.

CHARGE.

1. Funds at 31st December 1915 as valued at close of 1913,		£1579 1 11
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 94½	£472 10 0	
£500 Caledonian Railway Company 4 per cent. Debenture Stock, at 100,	501 17 6	
£400 North British Railway Company 5 per cent. Debenture Stock, at 74¾	297 10 0	
£400 North British Railway Company, No. 1, 4 per cent. Preference Stock, at 97,	388 0 0	
	£1659 17 6	
Furniture, etc., in Society's Rooms,	40 0 0	
	£1699 17 6	
Less Balance at Debit of Capital,	120 15 7	
	£1579 1 11	
2. Life Members' Subscriptions in 1916,		100 2 0
New Members,	£92 8 0	
Ordinary Members by commutation,	7 11 0	
	£1679 3 11	

DISCHARGE.

1. Proportion of Life Members' Subscriptions transferred to Revenue,		£137 0 8
Guaranteed £248 13 4 of Full Life Subscriptions,	£115 12 7	
Debenture 101 16 4 ⅓ of Commuted Subscriptions,	21 8 1	
2. Decrease in value of Railway Stocks since 31st December 1915,		42 7 6
3. Funds, etc., at 30th December 1916—		
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 66½	£331 5 0	
£500 Caledonian Railway Company 4 per cent. Debenture Stock, at 77½	388 15 0	
£400 North British Railway Company 5 per cent. Debenture Stock, at 57½	231 10 0	
£400 North British Railway Company, No. 1, 4% Preference Stock, at 71,	296 0 0	
	£1247 10 0	
Furniture, etc., in Society's Rooms, say,	40 0 0	
	£1287 10 0	
Less Balance at Debit of Capital,	157 14 3	
		1129 15 9
	£1679 3 11	

II.—REVENUE.

CHARGE.

1. Balance in hand at 31st December 1915,		£368 11 2
2. Ordinary Members' Subscriptions,		377 8 6
Arrears at 31st December 1915,	£47 2 6	
Add Arrears written off but since recovered,	1 16 0	
	£48 18 6	
Subscriptions for 1916,	£467 13 6	
Less Received in 1915,	8 0 0	
	392 13 6	
Subscriptions for 1917 received in 1916,	5 3 0	
	£446 15 0	
Deduct—		
Cancelled or written off as irrecoverable at 30th December 1916,	£15 3 6	
Arrears at 30th December 1916,	54 3 0	
	69 6 6	
	£377 8 6	
3. Proportion of Life Members' Subscriptions transferred from Capital,		137 0 8
4. Dividends and Interest,		64 0 6
5. *Transactions* sold, less purchased		13 2 9
6. Income Tax Recovered,		8 13 5
7. Donations to Special Fund to be used for creating an interest in Forestry among Young People—		75 0 0
From W. Rowan Thomson, Esq.,	£25 0 0	
Andrew Hamilton, Esq.	25 0 0	
A. L. Gray, Esq.,	25 0 0	
	£75 0 0	
	£863 17 0	

DISCHARGE.

1. Printing, Stationery, etc.,		£154 0 4
Vol. XXX, Part I. *Trans.*,	£69 13 10	
Authors' Reprints,	2 8 0	
	£72 1 10	
Vol. XXX. Part II. of *Trans.*,	£76 1 8	
Authors' Reprints,	2 19 6	
	79 1 2	
	£151 3 0	
General Printing and Stationery,	£34 9 6	
Forestry Periodicals, Binding, etc.,	4 0 0	
	38 9 6	
	£189 12 6	
Less Receipts for Advts. in *Trans.* and from Authors	35 12 2	
	£154 0 4	
2. Prizes (Money, £2; Medal, 17s. 6d.)		2 17 6
3. Expenses in connection with Excursion to Canadian Lumber Camp near Nairn		4 15 10
4. Contribution to Aberdeen Branch,		5 0 0
5. Fee to Reporter,		4 8 0
6. Expenses of Management,		259 5 8
Rent of Room and Taxes for 1916, and Hall for Annual Meeting,	£24 12 8	
Auditor,	3 3 0	
Hon. Editor's Assistant,	30 0 0	
Secretary and Treasurer,	125 0 0	
Advertising, Insurance, and Premium on Secretary's Bond of Caution,	5 10 7	
Councillors' Luncheons	12 18 8	
Postages and Miscellaneous Outlays, viz. Postages of Parts I. and II. of Vol XXX. of *Transactions*, £21 5 3		
General Postages, Communications on Cheques, and Petty Outlays,	36 15 8	
	58 0 11	
	£259 5 8	
Balance at close of Accounts made up thus,—		
1. Special Fund *per contra*	£75 0 0	
2. Balance of Revenue carried to next year, subject to payment of cost, etc., of January *Transactions*	478 9 8	
		553 9 8
Note.—Balance of Revenue as above,	£478 9 8	
Less Balance at debit of Capital as above,	157 14 3	
	£320 15 5	
Special Fund as above	75 0 0	
	£395 15 5	
On Deposit Receipt with National Bank of Scotland, Ltd.,	£375 0 0	
At credit of Account current with National Bank of Scotland, Ltd.,	13 19 0	
In Treasurer's hands,	6 16 5	
	£395 15 5	
	£863 17 0	

EDINBURGH, *23rd January* 1917.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 30th December 1916, of which the above is an Abstract, and have found them correct. The Securities, representing the Funds as above, have also been exhibited to me.

ALEX. J. MUNRO, *Auditor*

APPENDIX C.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY (ABERDEEN BRANCH).

REPORT 1916.

The Committee beg to submit the Eleventh Annual Report of the Branch.

The Membership of the Branch is 115, four having joined the Branch, and 23 having died, resigned, or left the area of the Branch during the year.

Two meetings of the Branch were fixed to be held on 18th December 1915, and 20th May 1916, it having been decided to depart from the usual four quarterly meetings in consequence of the war.

At the Annual Meeting held in December formal business only was transacted, and at the meeting held in May a discussion took place on "The Present and Prospective Condition of the Timber Trade arising from War Conditions." The discussion was opened by Mr C. S. France, and was taken part in by Sir John Fleming, Messrs Donald Munro, Rule, Clark, and Fyffe, and the President, and various interesting problems were discussed.

Although no Branch excursions have been held, an excursion, arranged by the Parent Society, in which many of the members of the Branch joined, took place to Nairn on Wednesday, 6th September, for the purpose of seeing the Canadian lumbermen, then at work on the estates of Cawdor and Darnaway. While the visit of inspection was instructive in many ways, the general impression of the practical men present was that foresters and woodmen in this country had not a great deal to learn in regard to the felling or cutting up of wood; especially was this the feeling if the question of economy, either of time, men, or material, was to be taken into account. After viewing the mills in operation, and the wood felling, the party walked through the forest to Darnaway, under the guidance of Mr Scott, the wood manager on the estate. This was, perhaps, the most enjoyable part of the excursion, some of the finest trees—larches, firs, and spruces—to be seen in this country being

inspected. Mr Scott has been forty-six years in the management of these plantations, and they demonstrate in a remarkable degree what good forestry will do.

The Committee beg again to record their thanks to Professor Trail and to the University authorities, for the use of the Botanical class-room to the Branch.

James W. H. Trail,
President.

George D. Massie,
Honorary Secretary.

Aberdeen, *December* 1916.

APPENDIX D.—Royal Scottish Arboricultural Society (Aberdeen Branch).

STATEMENT OF ACCOUNTS, Year 1916.

GENERAL ACCOUNT.

INCOME.

	£ s. d.
Balance at credit of last Account	£10 18 4½
Subscriptions from Members at 1s.	4 9 0
Savings Bank Interest	0 4 7
Grant from Parent Society	5 0 0
	£20 11 11½

EXPENDITURE.

	£ s. d.
Printing	£0 11 6
Postages and Incidental Outlay	1 4 8
Honorarium to Secretary for 1915	5 5 0
Transferred to Excursion Account	3 0 0
Balance at Credit of Account	10 10 9½
	£20 11 11½

EXCURSION ACCOUNT.

	£ s. d.
Transferred from General Account	£3 0 0
Balance at Debit of Account	0 11 1
	£3 11 1

	£ s. d.
Balance at Debit of last Account	£3 6 1
Charge for Seating at Craibstone Excursion omitted from last Account	0 5 0
	£3 11 1

LIBRARY ACCOUNT.

	£ s. d.
Balance at Credit of last Account	£1 11 6
Balance at Debit of Account	1 3 0
	£2 14 6

	£ s. d.
Bookcase purchased	£2 12 0
Postages and Incidental Outlay	0 2 6
	£2 14 6

ABSTRACT.

	£ s. d.	£ s. d.
Balance at Credit of General Account		£10 10 9½
Balance at Debit of Excursion Account	£0 11 1	
Balance at Debit of Library Account	1 3 0	
		1 14 1
Balance at Credit of Branch per Savings Bank Pass Book No. 393		£8 16 8½

Aberdeen, 12*th December* 1916.—I have examined the foregoing Statement of Accounts, and have compared same with the vouchers, and find them to be properly stated and vouched, the balance at the credit of the Branch being Eight pounds sixteen shillings and eightpence halfpenny, which sum is deposited with the Aberdeen Savings Bank, per Savings Bank Pass Book. No. C.393, which I have also seen.

Wm. WYLLIE.

APPENDIX E.

Office-Bearers for 1917:—

PATRON.

His Majesty The King.

PRESIDENT.

Sir Andrew N. Agnew, Bart. of Lochnaw, Stranraer.

VICE-PRESIDENTS.

Sydney J. Gammell of Countesswells, Countesswells House, Bieldside, Aberdeen.

John F. Annand, M.Sc., Adviser in Forestry, Armstrong College Newcastle-upon-Tyne.

W. H. Massie, Nurseryman, 1 Waterloo Place, Edinburgh.

Chas. Buchanan, Factor, Penicuik Estate, Penicuik.

The Duke of Buccleuch, Dalkeith Palace, Dalkeith.

COUNCIL.

Hon. Life Members.

Sir Kenneth J. Mackenzie, Bart. of Gairloch, 10 Moray Place, Edinburgh.

Sir John Stirling-Maxwell, Bart. of Pollok, Pollokshaws.

Ordinary Members.

Alexander Murray, Forester, Kingswood, Murthly.

J. H. Milne Home, Irvine House, Canonbie.

Thomas Bryden, Dennison Nursery, Ayr.

John A. Howe, Land Steward, Chisholm Estate, Hawick.

G. P. Gordon, B.Sc., Advisory Forest Officer, West of Scotland Agricultural College, 30 Renfield Street, Glasgow.

James Whitton, Superintendent of City Parks, City Chambers, Glasgow.

A. D. Richardson, 19 Joppa Road, Portobello.

Brig.-General Lord Lovat, K.T., D.S.O., Beaufort Castle, Beauly.

Frank Scott, Forester, Jeannie Bank, near Perth.

The Earl of Crawford and Balcarres, Balcarres, Fife.

Robert Allan, Factor, Polkemmet, Whitburn.

Brig.-Gen. Archibald Stirling of Keir, M.P., Dunblane.

J. A. Duthie, Nurseryman, Aberdeen.

A. MacCallum Scott, M.P., House of Commons, Westminster.

W. S. Curr, Factor, Ninewar, Prestonkirk.

Charles Robertson, Forester, Colstoun, Haddington.

Lord Forteviot, Dupplin Castle, Perth.

Alexander Morgan, Wood Merchant, Crieff.

George Mowat, Forester, Hamilton Estates, Riccarton by Hamilton.

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Additions to the Library since the publication of the List in Volume XXX. Part 2.

Books.

1. *Tree Wounds and Diseases: their Prevention and Treatment.* By A. D. Webster.
2. *British-grown Timber and Timber Trees.* By A. D. Webster.
3. *Seeding and Planting: a Manual for the Guidance of Forestry Students, Foresters, Nurserymen, Forest Owners and Factors.* By James W. Toumey, M.S., etc.
4. *Report of Smithsonian Institution*, 1914.
5. *New Zealand Official Year-Book.*
6. *Eilean à Cheò (Isle of Mist).* Presented by Col. Martin-Martin.
7. *Australian Forestry.* By D. E. Hutchins.
8. *British Forestry.* By E. P. Stebbing.
9. *Forest Valuation.* By Herman H. Chapman.
10. *Kew Gardens Bulletin*, 1915.
11. *Highland and Agricultural Society's Transactions*, 1916.
12. *Index Faunæ Novæ Zealandiæ.* Edited by F. W. Hutton, F.R.S.
13. *The Subantarctic Islands of New Zealand: Reports on their Geo-Physics, Geology, Zoology and Botany.* Edited by Chas. Chilton, D.Sc., etc. 2 vols.

Government and State Reports.

14. England:—
    (1) *Report of Commissioners of H.M. Woods, Forests, etc.*, 1915 16.
    (2) *Journal of the Royal Agricultural Society*, 1915.
15. India:—
    (1) *Statistics relating to Forest Administration*, 1914-15.
    (2) *Report of Forest Department of Madras*, 1914-15.
16. Indian Forest Bulletins:—
    (1) No. 32. *Note on the Burma Myrabolans or "Panga" Fruits as a Tanning Material.* By Puran Singh, F.C.S.
    (2) No. 33. *Note on an Enquiry by the Government of India into the Relation between Forests and Atmospheric and Soil Moisture in India.* By M. Hill, F.L.S., etc.
17. Indian Forest Records:—
    (1) Vol. v., part iv. *Œcology of Sal.*
    (2) Vol. v., part vii. *Note on Economic Uses of Rosha Grass.*
    (3) Vol. vi., part i. *The Life-History of "Diapus furtivus,"* Sampson.
18. Indian Forest Memoirs:—"*Pinus Longifolia,*" *Roseb.: A Silvicultural Study.* By R. S. Troup, F.C.H.
19. Australia:—
    (1) South Australia: *Report on State Forest Administration*, 1915-16.
    (2) Queensland: *Report of Director of Forests*, 1915.
    (3) Western Australia: *Report of Woods and Forests Department*, 1915.

20. New Zealand :—
    (1) *Report on State Nurseries and Plantations*, 1916.
    (2) *Report on Department of Lands and Survey*, 1915-16.
21. Canada :—
    (1) *Report of Director of Forestry*, 1916.
    (2) Bulletins of Forestry Branch :
        Game Preservation in the Rocky Mountains Forest Reserve. No. 51.
        Forest Products, 1914 : *Lumber, Lath and Shingles.* No. 56.
        ,, 1915 : ,, ,, No. 58A.
        ,, 1915 : *Pulpwood.* No. 58B.
        Canadian Woods for Structural Timbers. No. 59.
    (3) Bulletins No. 6 and 7 of Department of Agriculture.
22. United States of America :—
    (1) Ohio State University Bulletins.
    (2) University of California. Bulletin No. 261, *Melaxuma of the Walnut "Juglans regia."*
    (3) Yale University School of Forestry. Bulletin No. 4, *The Keene Forest.* By J. W. Toumey and R. C. Hawley.
    (4) Department of Agriculture :
        Forests of Porto Rico. Bulletin No. 354.
        The Strength of Wood as influenced by Moisture. Circular 108.
    (5) Pennsylvania :
        Report of Department of Forestry, 1914-15.
        Report of the Chief Forest Fire Warden, 1915. Bulletin No. 13.

Societies' and Institutions' Reports and Transactions.

23. England :—Association of Economic Biologists. *Annals of Applied Biology*, vol. ii., No. 4 ; vol. iii. Nos. 1, 2 and 3.
24. Ireland :—
    (1) *Economic Proceedings of the Royal Dublin Society :* "The Food Value of Great Britain's Food Supply," vol. ii., No. 11. By Prof. Thompson.
    (2) *Scientific Proceedings of the Royal Dublin Society*, vol. xv., Nos. 1-14, and Title vol. xiv.
25. Scotland :—
    (1) *Transactions of Perthshire Society of Natural Science*, vol , vi., part 3, 1915-16.
    (2) *Transactions of Botanical Society of Edinburgh*, vol. xxvii., part 1, 1915-16.
    (3) Natural History Society of Glasgow :—*The Glasgow Naturalist*, vol. vii., parts 1, 2, 3 and 4.
    (4) Royal Botanic Garden, Edinburgh :—*Notes for February, March and June* 1916.
26. Canada :—*Proceedings and Transactions of the Nova Scotian Institute of Science*, vol. xiv., part 2.

Reprints and Miscellaneous.

27. Journal and Leaflets of the Board of Agriculture. London.
28. Journal of the Department of Agriculture. Dublin.
29. *Journal of Agriculture.* Victoria.
30. *The Estate Magazine.*
31. *Bulletin of Economic and Social Intelligence of the International Institute of Agriculture, Rome.* September and December, 1915.
32. *International Review of Agricultural Economics, Rome.* May, Sepetember, October and December, 1916.
33. *L'Alpe.* Firenze.
34. *Tidskrift for Skogsbrug.* Christiania.
35. *Skogsvårdsföreningens Tidskrift.* Stockholm.
36. *The Indian Forester.*
37. *Forestry Quarterly.* Washington, D.C.
38. *Quarterly Journal of Forestry.* London.
39. *Canadian Forestry Journal.*
40. *American Forestry.*
41. *Timber Trades Journal.*
42. *Timber News.*
43. *Revue des Eaux et Forêts.* Paris. (By purchase.)
44. *Bulletin de la Société Forestière de Franche Comté et Belfort.* (By purchase.)
45. *Allgemeine Forst- und Jagd-Zeitung.* (By purchase.)
46. *Zeitschrift für Forst- und Jagdwesen.* (,,)

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A. W. BORTHWICK, D.Sc.,
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Mental Reckoning Tables. By A. Murray, Forester, Murthly. James H. Jackson, 26 High Street, Perth . 210

Estate Economics. By Andrew Slater. London: Constable and Co., Ltd., 1917, pp. xiii + 264. Many illustrations . 211

Forestry Work. By W. H. Whellens. Price 8s. 6d. net. T. Fisher Unwin, Ltd., London 212

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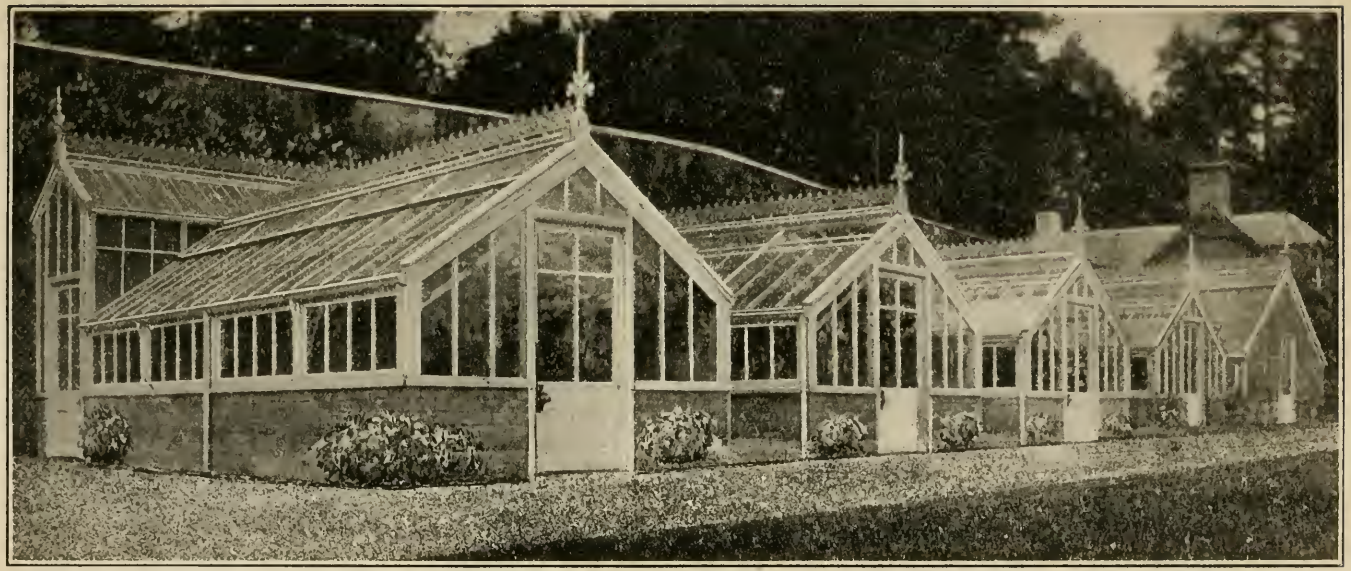

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Royal Scottish Arboricultural Society

FORM OF PROPOSAL FOR MEMBERSHIP.

To be signed by the Candidate, his Proposer and Seconder, and returned to ROBERT GALLOWAY, S.S.C., *SECRETARY*, Royal Scottish Arboricultural Society, 19 Castle Street, Edinburgh.

Candidate's

Full Name, ...

Designation, Degrees, etc., ...

Address, ...

Life, or Ordinary Member, ...

Signature, ...

Proposer's

Signature, ...

Address, ...

Seconder's

Signature, ...

Address, ...

[CONDITIONS OF MEMBERSHIP, see Over.

CONDITIONS OF MEMBERSHIP (excerpted from the Laws).

III. Any person interested in Forestry, and desirous of promoting the objects of the Society, is eligible for election as an *Ordinary* Member in one of the following Classes :—

1. Proprietors the valuation of whose land *exceeds* £500 per annum, and **others**, subscribing annually . . One Guinea.
2. Proprietors the valuation of whose land *does not exceed* £500 per annum, Factors, Nurserymen, Timber Merchants, and **others**, subscribing annually . . Half-a-Guinea.
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and **others**, subscribing annually . . . Six Shillings.
4. Assistant-Foresters, Assistant-Gardeners, and **others**, subscribing annually . . . . . Four Shillings.

IV. Subscriptions are due on the 1st of January in each year, and shall be payable in advance. A new Member's Subscription is due on the day of election unless otherwise provided, and he shall not be enrolled until he has paid his first Subscription.

V. Members in arrear shall not receive the *Transactions*, and shall not be entitled to vote at any of the meetings of the Society. Any Member whose Annual Subscription remains unpaid for two years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.

VI. Any eligible person may become a *Life* Member of the Society, on payment, according to class, of the following sums :—

1. Large Proprietors of land, and **others**, . . . £10 10 0
2. Small Proprietors, Factors, Nurserymen, Timber Merchants, and **others**, ... 5 5 0
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and **others**, ... 3 3 0

VII. Any *Ordinary* Member of Classes 1, 2, and 3, who has paid *Five* Annual Subscriptions, may become a *Life* Member on payment of *Two-thirds* of the sum payable by a *new* Life Member.

XII. Every Proposal for Membership shall be made in writing, and shall be signed by two Members of the Society as Proposer and Seconder, and delivered to the Secretary to be laid before the Council, which shall accept or otherwise deal with each Proposal as it may deem best in the interest of the Society. The Proposer and Seconder shall be responsible for payment of the new Member's first Subscription. The Council shall have power to decide the Class under which any Candidate for Membership shall be placed.

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

1. Report of General Meeting held in Christian Institute, Bothwell Street, Glasgow, on Wednesday, 11th July 1917.

At the beginning of the meeting, Sir Andrew Agnew, who occupied the chair, said:—"I believe this is the first meeting of the Arboricultural Society of this kind which has been held in Glasgow. It was recently brought to the notice of the Council that there were a number of members in the West of Scotland who would like to attend the meetings and to take part in the discussions, and who found it very difficult to attend the meetings in Edinburgh. The Council therefore decided that the summer meeting, which is usually held in connection with the Highland and Agricultural Society Show, should take place this year in Glasgow. I am glad to see that there is a considerable turnout of members. I think it shows that we were right in coming here, and if there should be a general desire that similar meetings should be held in future in Glasgow, there seems no doubt that they could be easily arranged.

"Since the last General Meeting of our Society, the most important thing that has happened in connection with forestry is the fact that the Committee specially appointed to advise the Government on the subject of national afforestation has concluded its enquiries and presented its report. The recommendations of the Committee have not yet been made public; but, from what we know of the necessities of the case and of the men who have been considering them, we may feel pretty confident that the Committee will advise immediate action, and probably action of a far-reaching character. I do not think there would be much use in speculating upon what the

proposals are likely to be: I hope we shall have them before us very soon. In the meantime, I should just like to say a few words on the part taken by the Council of this Society in helping the Forestry Committee to arrive at their decisions.

"At the request of the Committee we drew up a statement dealing with the whole problem of State afforestation, in which we set out as clearly and concisely as we could our views and recommendations on the various branches of the subject. The statement has been printed in the volume of our *Transactions* which has just been published, and I hope to hear that you are prepared to give your approval to the recommendations it contains. It would have been more satisfactory if we could have drawn up that statement after direct consultation with the rest of our members. I wish we had been able to do this. Unfortunately the request of the Committee only reached us a few days after our Annual Meeting had been held. That meeting was attended by members from all parts of Scotland, and it was, of course, impossible to expect them all to come together again a fortnight later. Time was pressing, and as it was necessary to act without delay, the Council prepared and sent up the Memorandum on their own initiative. But though the views expressed in the Memorandum only profess to give the views of the Council, I hope and believe that they reflect very closely the views of our Society as a whole. The problem of State afforestation has been before us so long, and it has been discussed on so many occasions, that there is scarcely a point on which we did not feel acquainted with the views of our fellow-members; and therefore I am confident that, as a whole, the statement will meet with your approval. There is only one point on which the views of the Society have not been directly expressed, but I think you will say we were justified in the recommendation we made upon it when you know the reasons that influenced us.

"The point is a very important one, for it concerns the question who should be the official authority to initiate and carry out the policy of national afforestation. Hitherto forestry has been under the control of the Board of Agriculture, and the results, as we all know, have been very unsatisfactory. We hoped that forestry might receive more attention if it were placed under a separate branch of the Board, with a separate staff and a separate fund; but though we have frequently

urged this upon the Government, we have never been able to obtain it. Under all the circumstances, the Council considered that the time had come when we should make a bolder demand, and we have asked for the creation of an independent Forestry Department for the United Kingdom, with branches in England, Scotland, and Ireland. You will observe in the Memorandum that we have not abandoned our former request for a separate branch of the Board of Agriculture, but we have put it in the second place. We considered that an independent Forestry Authority would be far more effective, and that only if there were really cogent reasons against it—only in that case should forestry remain under the Board of Agriculture. I may say that there was no point on which the Council were more decided and more unanimous than on this question of the Forest Authority. Let me give you very briefly the reasons that influenced us, and when you have heard them I hope you may feel as clearly as we did that we were justified in the new departure we have made.

"In the first place, scarcely anything has been done for forestry during the many years that it has been under the Board of Agriculture. The chief cause was that the Board was too busy with agricultural affairs to have either time or money to spare for forestry. But if this was the case before the war, how much more will it be the case when the war is over. The work of the Board has been nothing in the past compared to what it is bound to be in the future. For the first time agriculture is going to be treated as an industry of national importance, and it is to be stimulated as it has never been stimulated before. Farmers are to be encouraged to grow bigger crops, millions of fresh acres are to be brought under cultivation, innumerable small holdings are to be created for the benefit of soldiers and sailors returning from the war, the problem of rural housing, which was already serious enough before the war, will be ten times more serious and more pressing when the war is over. What chance would forestry have if it were left to the care of a Department which had urgent problems like these upon its hands? This of itself must render some change necessary.

"But if agriculture is going to claim so much more attention than formerly, and to entail so much more work, the same is true of forestry. The position of forestry has changed a good

deal in the last three years. Before the war a certain number of people had come to see that a large increase of home-grown timber was desirable; to-day every one recognises that it is an absolute necessity. Afforestation, when it begins, will be carried out on a much larger scale than was contemplated a few years ago; and the arrangements which might have sufficed a few years ago are no longer sufficient for the needs of the time. Forestry, in fact, has outgrown the Board of Agriculture, and can provide work enough for a Department of its own.

"Again, the State will be embarking upon an entirely new business, a business of a very technical character. Everything will depend upon the way in which the work is started. It can only be started successfully under the guidance and superintendence of men who have made a study of the subject. It is no use expecting forestry to thrive and develop when it only receives the snippets of time that a President of the Board of Agriculture can spare from more engrossing problems. It can only develop into a real national industry if it is placed from the first under the direction of men of the right training and experience, men who can give their individual attention to the subject, men who really comprehend both the results to be aimed at and the methods by which those results can be attained.

"And there is still another reason for separating forestry from the Board of Agriculture, and that is, as far as possible, to keep it clear of politics. Agricultural policy has always had to conform to political views. The head of the Board of Agriculture is changed with every change of Government, and has to adapt the policy of his Department to the views of his party. Forestry has nothing to do with politics. It is not political, but scientific. When once the politicians have decided that national afforestation is necessary, when once they have settled the extent to which it may be carried out, the rest should be left to experts. I do not see why there should be any special difficulty about it. At any rate, that is the only way to ensure continuity of policy as well as scientific management; and without continuity of policy and scientific management, national afforestation is certain to prove a disappointment.

"These are the reasons which induced the Council to recommend strongly the creation of a separate Forestry Department. They were persuaded, first, that the Board of Agriculture would

be far too busy in the future to give sufficient attention to forestry; next, that the subject of forestry had grown so large that it would provide work enough for a Department of its own; thirdly, that being a new departure it was important to start it upon sound lines, and that this could only be done under the direction of experts; and finally, that it was essential to put forestry in a position in which it would be unaffected by political changes. I hope that the reasons which convinced the Council will convince you also, and that we shall receive your full support in the request we have made for an independent Department of Forestry. I will ask Sir Hugh Shaw Stewart to move a resolution with regard to this."

Sir Hugh Shaw Stewart moved approval of the proposal that the management of forestry in the three kingdoms should be under an *ad hoc* Forestry Board, not under the Board of Agriculture. He said:—"I am speaking in the presence of many of those who know something about forestry, and a number of those who know a great deal about it, and I am sure that they will agree that I am not exaggerating when I say that there are only two ways in which any one can know anything about forestry. One is a close and intensive study in youth, or half a lifetime in practical first-hand knowledge of the work of forestry, or preferably a combination of those two. That is the only kind of practical knowledge we would expect in the work before this country if it is going to seriously take up afforestation in Scotland, England, and Ireland. There is no Board of Agriculture that we have seen which has had at its head any one who professes any close acquaintance with forestry, and—apart from all the reasons which you brought forward about the enormous addition to the work of the Board of Agriculture in Scotland, England, and Ireland—it is simply common-sense that forestry operations should be under the guidance of a Board composed of men who have practical acquaintance with arboriculture, either from close intensive study in youth or from half a lifetime of practical acquaintance with it."

Sir Hugh Shaw Stewart then read from page 90 of the last part of the *Transactions* (vol. xxxi.) the Council's recommendations with regard to the duties of a Central Authority (Nos. 1, 2, 3, 4, 5, 6, 7, and 8). "I am sure," he continued, "we have only got to read over that list of some of the duties which will fall to the Authority which is set up to deal with forestry, to

commend to all of us the belief that it can only be by a Board appointed *ad hoc*. I beg to move that."

Mr Paton, Kilmarnock, said:—"I have much pleasure in rising to second the resolution. There is one side of the question which has been entirely omitted from this statement, and that is how far trees now growing can be utilised. We know that in the nurseries of Great Britain there are millions of forest trees that are all available for planting, and if it were a recommendation to the Government to allow a certain number of men to go on planting, seeing that the country is being denuded of forest trees, it would be a matter of furthering afforestation by a great number of years. To begin to sow in the future seeds of trees that must be grown in the nurseries, transplanted from there and carried to the forests, means a delay of five or six years before this can be accomplished. We have a practical demonstration of what can be done at present in the way of labour being got from the Government. In Lanarkshire they have planted a large area of forest trees this year that would otherwise have gone into the fire. That has been done by German prison labour. What has been done can be continued if a recommendation is made to the State along with the recommendations of this Committee. I think those who are practical will agree with me that they are all within the area of practical politics. I have much pleasure in seconding the recommendation with an addition of this kind."

The Chairman.—"I would say, in reply to Mr Paton, that of course it is impossible to add that to this particular Memorandum, because it has already been sent up to the Sub-Committee on Forestry, who have now sent their report in to the Government. Therefore we cannot now add any addition of that kind, but we can keep that in mind for any future recommendation. I think it would be a very useful subject for discussion, and it might come into our discussion presently."

The resolution was adopted unanimously.

Sir John Stirling-Maxwell, Bart., opened a discussion on "National Forestry." He said:—"Mr President, you referred just now to the report of the Reconstruction Committee. I cannot, as a member of that Committee, say much about it, but I would like to take this opportunity of thanking the Council for the help they gave to the Committee in providing them with this document. Without disclosing any secrets, I might

mention the methods of enquiry the Committee followed. They did not take evidence. There was on record an immense mass of evidence on forestry development. They did not consult bodies like this in advance, but they tried to form their own opinion on the facts of the case. They then asked for advice from this and kindred bodies, compared your views with those they had formed, and I think in that way they got as near good recommendations as any body of men is likely to get. I may add that since the Committee like yourselves started from a knowledge of the facts of the situation, and of the needs of the day, it is perhaps not surprising that they arrived very much at the same conclusions.

"For the last three years every one engaged in the organisation for war has known how dearly this country is paying for the neglect of a great national industry. The Prime Minister has told us that timber absorbs more shipping than any other import, and that we can only ensure imports of food by foregoing imports of timber. He described the situation to the House of Commons as 'one which undoubtedly calls for the gravest uneasiness.' We have now reached the stage when the use of imported timber, except in small quantities, is prohibited unless it receives official sanction. Recently it has been found necessary to withhold sanction even for the erection of huts for the service of our soldiers and munition workers. There is no seasoned home-grown timber to fall back on, and no time to season any. The demand is too pressing. Everything is used as it is cut. For the army we are mainly dependent on the French forests. Had our Allies neglected forestry as we have done, the war could not at this stage have been carried on at all. I shall not waste time in dwelling on what might have been, but it is only fair to this Society to point out that if its advice had been taken, things would be very different now. We should at least have been secure in the vital matter of pit-wood, and we should have had sufficient men skilled in the conversion of wood, to enable us to surrender the younger men to the army without paralysing our efforts to make the most of our native timber. One hesitates to speak of money in these days when money does not seem to count, but money is strength and we still have to face the bill. We had the great good luck to be able to import timber for the first two years of war, but the cost in increased price, freight and

insurance amounted in these years to some forty millions more than we need have paid for home-grown timber. This money might as well have been thrown into the sea. A railway company, of which I am a director, was paying 14s. for imported sleepers, while home-grown sleepers quite as good were being despatched to the army in France at 3s. 6d. After all, forty millions is a considerable sum. A tithe of that sum, wisely laid out even thirty years ago, would have saved most of this loss and proved a good investment into the bargain.

"How far these arguments will be strengthened by the experience of the coming months, we do not know. We can only pray that they may not be strengthened by disaster. They already suffice to convince any thoughtful person that the forest policy of this country can no longer be left to chance. I am not only thinking of war, or of those trade boycotts which will assuredly take the place of war if the statesmen of to-day succeed, where the whole world has hitherto failed, in eliminating force from the settlement of international disputes. I am thinking scarcely less of times of peace. Coniferous timber, which composes nine-tenths of our imports, is the anxiety. It is not many years since the virgin forests of the United States were considered inexhaustible. To-day they are insufficient for the strain of war, and the President is looking to Brazil for help. Already before the war the Americans had absorbed the supplies which Canada used to send to us. Should Russia, on which we have latterly been mainly dependent, now enter on a period of development, she will soon, like the United States, herself absorb the whole produce of her forests. The price of timber has for years been steadily rising, and the time is coming when countries which have no timber of their own will fare very badly. People who talk glibly about the housing question forget how near the heart of that question this matter lies. A dip into the literature of the United States would show them that it was the forest which solved for the builders of that country the problem of comfort and cheapness.

"While the needs of peace will make themselves gradually felt and increasing prices will tend to provide the required supplies, it is otherwise with international disputes, and it is against the sudden shock of these that the statesman will have specially to prepare. Whether they take the form of war or of trade boycotts, it is certain that the defensive strength of this country

will depend on its ability to dispense with imports for a limited period. We have at present three million acres of wood, of which perhaps two million are or might be coniferous forest worked on economic lines. I cannot within the limits of the time at my disposal tackle the estimate in detail. I can only state my belief that if these two million acres were made fully productive, the afforestation of another million and a half acres would make us reasonably safe. Possibly others here, who have devoted more study to the subject, will agree in this conclusion. The calculation is one which any one may make for himself, imports being reckoned in loads and a load representing pretty fairly the average annual production of an acre of well-managed coniferous wood. Whatever the precise amount to be afforested may be, it constitutes a considerable change. I may leave it to others to discuss to-day how it can be introduced with the least possible disturbance into the complicated structure of our national life.

"Let me mention one technical point as specially concerning this Society. The more the subject is studied, the more certain it becomes that the great problem of afforestation in Scotland is the utilisation for timber-growing of that class of moorland which is too high or too poor to winter live stock, but which, if the superficial difficulties can be overcome, is capable of producing crops of timber much above the minimum which is held to justify afforestation in continental countries. A great deal of evidence bearing on this question, in woods of all ages, must be available if only it were collected. I would suggest that there is here a practical piece of work which the Society might take up. It follows naturally from the survey made and published some years ago.

"I make no apology for reminding you once more of the foundations on which any forest policy worthy of the name must be built. Nothing has occurred to cause this Society to modify the opinion it expressed nearly ten years ago as to the nature and order of these antecedent steps:—

"First, we demanded a Central Authority devoted to forestry and forestry alone.

"Secondly, a Demonstration Area where complete records could be kept, forest officers and working foresters trained, and the science of British forestry built up.

"Thirdly, a survey to ascertain the extent and value of land capable of growing timber.

"Had these steps been taken when we urged them upon the Government all would be ready for a beginning now. It is clear from the speeches of Mr Lloyd George, when as Chancellor of the Exchequer he supplied the Development Commissioners with funds for forestry, that he intended all these steps to be taken. I wonder whether he knows how completely his plan has miscarried.

"The Forest Authority must be something very different from the Development Commission, which has directed the destinies of forestry for the last nine years. I have no wish to attack the Commissioners. I dare say they are doing their best. But the system is grotesque and must be exposed. The Commissioners, having themselves no acquaintance with forestry under British conditions, could only have succeeded if they had followed the advice of the Departments appointed to take charge of the subject, and societies like this. This they have not seen fit to do. We judge them by what they have done and what they have left undone. They decided on a policy of education. It might well be called a policy of pedantry. The United Kingdom, with three million acres of wood, can now boast six centres for the higher teaching of forestry. France with eight times as much finds a single centre sufficient. They rejected the scheme submitted to them for the purchase of a Demonstration Area in the principal woodland area in Scotland on the ground that it was not sufficiently central. The whole purchase price of this estate could have been recovered from sales of timber during the last three years without materially destroying its educational value. The correspondence on this subject has been printed. It is time you pressed for its publication. The French are more practical. They placed their teaching centre at Nancy—though it is on their eastern frontier—to be in touch with their principal forests. In this country it seems to have been forgotten that in forestry, science scarcely exists apart from practice. So we are still without a Demonstration Area in Scotland.

"In England the Crown forests have for some fifteen years been under skilled management and are, with their records, available for study. Let us give our pedants credit for having built a school in the Forest of Dean. Scottish students will have to be content with that school, and they might do worse. This forest and the neighbouring Tintern Woods are full of

well planned and most interesting work to which I know of no parallel in Scotland. A visit to Inverliever last week brought home to me how far we have been left behind. This estate, purchased by the Office of Woods out of Crown revenue, is administered by the same officers as the forest I have mentioned. The site is not ideal, but it is typical Scottish moorland. The planting on the best ground has succeeded admirably, but in the earlier work the difficulties of the higher ground were not fully grasped. That phase is past. The earlier plantations and various methods of planting have been carefully studied, the soil classified by its natural herbage, and a soil map prepared which is far ahead of anything of the kind I have seen attempted elsewhere in Scotland. This is the work of the English Department which bought this estate and is responsible for its management. They have had the good sense to employ an experienced Scots forester—Mr John Boyd—and to take him entirely into their confidence. Such work directly advances the science of forestry. All honour to the Department which is doing it. But is it not pitiful to think that not one of our Scots forest officers, advisers or lecturers has ever had the opportunity of working out these practical problems? Surely the piling of teaching centre on teaching centre, without securing a field for practical work, without gauging by a survey the afforestable area, without a single scheme of afforestation to provide openings for the men you train, is an instance of pedantry gone mad.

"It is true that after repeated refusals the Commissioners have given small grants for surveys in the three kingdoms, but these are scarcely begun and no attempt has been made to co-ordinate their methods. The survey of Glen More made by this Society at its own expense remains the only complete survey yet attempted. The blighting influence of this system under which the expert is over-ruled by the amateur, is felt in every department of forestry, and the results often have a grotesque humour about them. Emergency seed-beds have recently been started in the Crown forests, and, no other funds being available, the Development Commissioners have provided a modest grant. They also deputed—quite rightly, no doubt—two of their number to inspect the work, which, mark you, is already inspected by the Crown inspectors in charge of the forests. The envoys of the Development Commission

have taken advantage of the recent fine weather to make their inspection. As neither of them has had any experience in the management of British nurseries, their visit cannot have been of the slightest value. Let us hope they enjoyed the outing. In railway fares, motor hires, and hotel bills, it is understood to have doubled the cost of the plants.

"It is time all this nonsense was swept away. A policy such as I have ventured to sketch, and such as this Society has steadily advocated, cannot be carried out by this sort of muddling. The job must be entrusted to men who understand it. A definite responsibility must be attached to them. They must not play at forestry, but face the facts and take in due order the practical steps essential to the re-establishment of this lost industry.

"I would not like to put all the blame for the inaction on the Development Commissioners. I know they have had difficulties, and in Scotland they have had to work with a very difficult department in our Board of Agriculture. I do not know whether the attitude of that Board to forestry as contrasted with the friendly attitude, which we all know and welcome, of the Forestry Section under Mr Sutherland and Dr Borthwick—I do not know whether the attitude of the Board as a whole has been fully grasped. When the Board was set up in 1911, Lord Pentland said in his speech in the House of Lords, 27th November: 'It is the intention of the Government that there shall be under the Board of Agriculture, as an integral and vital part of its administrative machinery, a department dealing with forestry, which shall be developed as the needs of forestry may justify in Scotland, and which shall be equipped with competent and efficient advice in the matter.' That speech embodied what seemed to us a very clear promise that this integral part of the Board would share in the funds of the Board, but after the legislation was finished and the Board set up, the Chairman entirely refused to give for forestry any grant from the funds apportioned to the Board. That refusal was maintained till quite recently, and the Development Commissioners have consequently had to be relied upon for every expenditure required on forestry in Scotland. This action on the part of the Board, which I believe to have been wholly illegal, has been responsible perhaps as much as any action on the part of the Development Commissioners for the way in which

forestry has been held up here. I think we, perhaps, as a society, have been a little slack in the matter, but our hesitation to press it home has sprung from a certainty that Mr Sutherland and his colleagues in the Forestry Section were doing their very best, and from fear that any action on our part might embarrass them. And certainly during the very brief period that Mr Tennant was Secretary for Scotland he reversed this state of things. He brought the control of the funds of the Board of Agriculture more directly under the control of the Secretary for Scotland, and he insisted on funds for the planting of the estate of Borgie out of the funds of the Board. I have no doubt his successor, Mr Munro, will see through this project—the first and only attempt the Board has yet made in the direction of afforestation."

Sir Charles Bine Renshaw, Bart., said:—"I take it that the invitation which was extended to me to be present to-day to take part in your proceedings really had for its object an expression, on the part of one who is associated with railway work in Scotland, of willingness and readiness to avail ourselves of supplies of home timber, if and when they are placed at our disposal, on a larger scale than we have hitherto done. The immediate position with regard to timber supplies in this country, as the Chairman remarked in his opening speech, is a very serious one. An inter-departmental committee is sitting which is regulating the use of timber as far as it is available, and on that committee the railway companies are represented. I saw a report in connection with the subject as recently as 4th July, and it is not very cheerful reading, with regard to the immediate prospects of getting sufficient supplies of timber. The position of the railway companies at the present time is almost as difficult a one as the position of the Arboricultural Society in its relations to the Government and the policy which the Government is carrying out with regard to the Society. We are expected to maintain in thorough efficiency the transport services of the country. We are getting no steel rails; the use of sleepers for our permanent way has been largely reduced in consequence of the shortness of the supply of timber, and only within the past fortnight an edict has been issued that we are to cease to creosote timber, because the creosote is needed for other purposes. That of itself is a serious shortening of the sleeper supply of the country, because our experience has shown that whereas

creosoted sleepers have a life of about fifteen years, uncreosoted sleepers have a life of about half that period. I take it, Mr Chairman, that perhaps it would be interesting to your Society if, on the authority of one who has been working specially at the supplies of timber in connection with my own railway—Mr Easton—I gave you some approximate indication of what the uses are to which we apply timber, and what are the sources of supply of this timber at the present time. We use timber on railways for sleepers and for scantlings. We use it for logs, for fencing, telegraph poles, chair keys and waggon sprags, and we also use considerable quantities of ash and other timber when it is available. I heard recently that Sir John Stirling-Maxwell had been at Invergarry, and had suggested that certain birch trees should be cut down with a view to experimenting in their use as sleepers. That I think is a very good suggestion, and it may be a very useful one in the future. The amount of timber we use upon railways in the United Kingdom, as far as I can estimate it, is about 34,000,000 cubic feet in a normal year—that is of finished wood, and you will know how much larger a quantity of round timber that represents. Of that supply, in Scotland we use about 2,400,000 cubic feet which comes from the Baltic and White Sea. We use about 970,000 cubic feet of American wood, and 900,000 cubic feet of timber grown at home, also 50,000 cubic feet of teak and other timbers. It is estimated that in England the use of Baltic and White Sea timber in a normal year is 20,000,000 cubic feet; of American timber, 6,500,000 cubic feet; of home-grown, 2,630,000 cubic feet; and of teak and other high-class woods, 350,000 cubic feet. Of home-grown timber you will see we only use about one-tenth in normal times—that is, in pre-war times. Let me give as a further instance the case of sleepers. The consumption of sleepers on the lines throughout the United Kingdom is about 54,000,000 a year. That would be about 17,000,000 cubic feet, and a very small proportion of that is derived from British timber. And yet both Scots fir and larch make an equally good sleeper, and I am bound to say that if the railway companies could only get them offered in sufficient quantity on appropriate terms a very large use might be made of them. With regard to white and red pine, deals and battens, these are largely used for waggon building. At present the supply of these almost entirely comes from abroad. Larch and Scots pine would do equally well, and

might, if available, be largely used in place of these foreign imports. American oak, scantling and logs, are used in carriage building and waggon building. I suppose the longer size of these will always have to be derived to a certain extent from abroad, but home oak is quite suitable for a large proportion of the scantling, and possibly 2,000,000 cubic feet could be used if it was made available for railway service. With regard to American pitch pine, scantling and logs, these are largely used by the engineering department and the locomotive department in carriage and waggon work. Larch and other home timbers might be substituted to a considerable extent. I have seen an estimate that about 22,000,000 cubic feet of home grown timber, if it was available, might be used on our British railways. Of course, that represents, as I have said before, a much larger cubic measurement in round timber. I understand there is a feeling on the part of arboriculturists, occasionally, that the British railways look rather askance at the supply of home-grown timber. I think that is an entire delusion, and, speaking for my own railway, I can say that we have always availed ourselves of all the Scottish-grown sleepers and wood of that kind that has been placed within our reach. I think the great North of Scotland and the Highland lines have also done so. One of the difficulties we always have to contend with regarding the purchase of these supplies is the small quantities in which they are put before us. When you are dealing with a consumption so large, it is almost impossible to buy in the small quantities, and the intermittent quantities, which are offered. What is wanted is a careful consideration of the problem of how you can place the supplies of home-grown timber before the railway companies in bulk. There is one other question I should like to allude to, and it is this. As far as prejudice is concerned, it is possible that there was some reason why in the past railway companies have rather shown a preference for foreign timber. I think you will follow me when I say that from the very nature of things foreign timber which is cut down at a great distance away, which takes some time to bring to the seaport, and which then takes some time in transit, must be better seasoned than timber which is cut down fresh in this country. When it comes to be a question of the use of this timber upon the railways, I think it is not unnatural that those who have to look for a supply should satisfy themselves that they are getting the best article

for the price they are paying, and should look at the fact that the timber which comes from abroad, owing to it being better seasoned, is ready for creosoting at the time of its purchase. The timber which is available in this country, being fresh timber delivered shortly after it is cut, does not take on creosote so readily. I was talking only yesterday to a gentleman who superintends that department in connection with railway work, and he told me that while a sleeper seasoned for twelve months would absorb three gallons, a sleeper cut only one or two months would scarcely absorb any creosote at all, for it would not penetrate to any depth. When I tell you that the life of a creosoted sleeper when it is properly done is about twice the length of an uncreosoted sleeper, you will realise how not unnaturally railway officials look to the importance of having good seasoned sleepers placed at their disposal. I hope that the result of your meeting will be to foster and develop the growth of home-grown timber. I am afraid that on the railways we would be somewhat sanguine if we were to look forward to an immediate result from what is going on at the present moment, but I do hope that in the not distant future it will be possible for the railway companies to obtain a much larger supply of the timber which they are using from British sources, and not from foreign countries."

Mr C. Augustus Carlow, of the Fife Coal Company, addressed the meeting on "The Utilisation of Timber by Mines." He said:—"I appear as a very poor substitute for Mr Nimmo, the chairman of the coal trade, who, in his many duties, has been called to attend meetings in London of very great importance. Unfortunately, it is only within the last twenty-four hours that I have been informed of this meeting or of the subject on which I am to address you. I therefore trust that you will excuse me if I am brief and put what I have to say, which, I fear, will be somewhat scrappy, before you in a very crude and unpolished manner. I quite sympathise with Sir Charles Bine Renshaw in what he said as to the difficulties of carrying on the railways or any industry of such magnitude and importance in these times, and I can say exactly the same thing in endeavouring to carry on the coal-mines. One of the principal difficulties has been the shortage of pit-wood. Prior to the war practically the whole of our pit-wood was brought from abroad. You will therefore understand the amount of dislocation which our busi-

ness has been put to in this regard when I say that practically the whole of our pit-wood now is grown in this country. If I may put it in figures, our own company used, I believe, the largest quantity of pit-wood used by any coal company in the country. It is not a thing I wish to boast about; it is a pure and undefiled statement of fact. In order to put figures concisely, it will be more convenient to deal in miles than cubic feet. Our pit-wood is purchased by lineal feet, and what we require for carrying on our collieries alone for a working day is about 20 miles of pit-wood. At the end of the year it comes to about 5000 miles of pit-wood put end to end to supply the collieries with which I am connected. Therefore, when the war began we put ourselves about to purchase. We went up and down the country as far as we could, purchasing standing trees. But I fear this is history, and what you would prefer me to go into is the probable use which we will be able to put home-grown pit-wood to after the war. Looking to the future as far as one may or dare in the present circumstances, I think this, that the mines always will use a certain amount of pit-wood, be it great or small. In the main roadways of the mines we have tried innumerable substitutes—brick-work, steel arches, girders, ferro-concrete, plain concrete, concrete blocks made upon the surface to the shape of the roadway and set in pure cement, even props made of stone and bound together by a secret process which I cannot at the moment describe, even props made of bricks put one above the other where the height is only about 20 inches. These are a few of the substitutes which have been tried in the mines to replace wood. You will understand, I am sure, that we could go to the cost of those substitutes only because they last longer than any quality of pit-wood which has as yet come before us. The reason why wood is preferred is that it has a certain yielding property before it breaks. What we want in props is a substance which will show that the pressure on the roof is becoming dangerous before the prop itself breaks and allows the roof to collapse. Timber is the only substance of that kind readily available in sufficient quantities, therefore I think we are quite safe in saying that timber will be wanted in the collieries in the future as it has been in the past. Even where steel props are used, it is the almost invariable practice to give the steel props a copping and a sole of wood in order that there may be some-

thing to yield and indicate danger before even the steel props fail.

"As to whether the supplies of pit-wood for the future are to come from this country or from abroad is a matter which appears to me depends on two things, quality and cost. If the Scottish forests can supply us with as good a quality of pit-wood and at as moderate a price, you may be assured that the Scottish mine-owners will all go for the home supplies. But if, on the other hand, we can import pit-wood of better quality and at a cheaper rate, I think you may assume also that the sources of pit-wood will go back to where they were before the war—Scandinavia, Finland, Russia, generally speaking, the ports on the Baltic. It therefore is, I think, a question for this Society to see if, by their skill and science, they can raise pit-wood to compete economically with the foreign product. What is wanted in the matter of quality is, for prop wood, trees which are straight and well seasoned. I believe that the fibre of the wood grown in this country is as good as the fibre of the wood grown in Finland, but it is equally undeniable that the Scandinavian finished props arrive in this country in better condition. They are straighter. They are more clean grown, and they are better seasoned. The seasoning is a matter which is easily overcome, but I fear the straightness and the cleanness of the growth are matters which are more difficult to overcome. Then in what we term bars, that is, crowns designed to take a bending pressure rather than an end thrust, we have all along used home larch, which is unbeatable in that respect. No member of this Society will go wrong in planting areas of larch. All the way through we have always used home larch, and we have found no substitute to beat it for our purposes. In hardwoods we do use a considerable quantity of oak of small sizes and large sizes. I mean by small, pieces suitable for hutch-trams, and slots and under-frame of the tubs, and railway keys. By large, I mean waggon frames. The side beams of a waggon being 12 by 5 and 18 feet long, you will appreciate at once pretty much the size of oak tree to be suitable for making waggon wood. Prior to the war the whole supplies of waggon wood came from America—American white oak. It was brought into this country at a price which, I think, would undercut any home grown. However that may be, if you can succeed in beating the quality and price of American oak, I can assure you that

for ourselves, as well as for the railway companies, there is an immense field for the utilisation of home-grown oak. It is a matter of quality and price; whether the members of this Association can supply an equal article at an equal price. If that is possible, there is an immense field for all the pit-wood and all the oak which you can see your way to grow in Scotland."

Sir Hugh Shaw Stewart.—"May I ask Mr Carlow if he has had any experience in the use of home-grown Japanese larch?"

Mr Carlow.—"I think not."

In the absence of Colonel Stirling (the author), Mr Galloway then read the following paper on "Afforestation in Relation to Deer Forests and Sheep Farms":—"The great bulk of the land for afforestation in Scotland must come from one of the three following sources:—

1. Deer forests.
2. Sheep farms.
3. Summer grazings.

"Of these the second category is the largest, and contains relatively to its size the highest proportion of ground suitable for the growth of timber. Unfortunately the difficulties in this case are the greatest, because there is a limit to the amount of ground which can be enclosed against sheep without destroying the wintering value of any farm, and therefore making necessary the removal of the sheep stock in winter. It is not intended to enter here upon the relative national economic importance of timber as compared to mutton and wool. It is assumed that at the present time, and for some years to come, nothing can be done which would tend to lessen the home production of mutton and wool.

"Therefore it may be convenient to look, in the first instance, to the contribution of afforestable land to be made by the two remaining categories. It may be said at once that the contribution to be made by summer grazings is not very important. They lie, as a rule, at such a height that only a very small part of them could be planted profitably, and it is probable that their chief value will be in connection with adjoining deer forests and sheep farms, where some extension of planting may be made conveniently on adjacent summer grazings.

"The rents of summer grazings are very low, and no appreciable

loss is likely to be caused by the enclosure and planting on the relatively small area which may be found suitable.

"With regard to deer forests, it may be said that a good deal of the land which they contain is too high for profitable planting: even taking 1500 feet as the upper limit for planting — and in many cases of new plantations 1500 feet would be too high a limit—some deer forests would show very little plantable land as compared to their area. But there are deer forests, especially towards the west coast, which have a relatively large area of plantable land. Here again, as in sheep farms, the question of wintering will arise. Deer forests before the war made a very considerable contribution to the rates in several Highland counties. If the rents of deer forests are to be maintained, it is obvious that no very drastic alteration in the present conditions can be made. The large stocks of deer in Scottish forests make it quite impossible to plant successfully without fencing the deer off the planted ground, and if the whole of the wintering ground were to be enclosed at any one time, the sporting value of the remainder of the ground would be greatly reduced. Probably one-third of the wintering ground is as much as could be enclosed against deer at any one time. The shelter provided by woods would eventually become of great advantage to the deer, but in the numbers in which they exist at present they could not be admitted safely to young plantations under twenty-five to thirty years old.

"Perhaps the solution of the question may lie in the direction of a greatly reduced stock of deer, which, living under better conditions, would produce heavier stags and better heads than are found in Scotland at the present day. But the whole conditions would be changed: the shooting tenant would have to be content with fifteen or twenty stags, where he now kills one hundred to a hundred and twenty, and it remains to be seen whether under the altered conditions it would be possible to obtain tenants at anything like the present rents. Without a survey it is no use attempting an estimate of the amount of land which could be planted eventually in the deer forests. If the whole of the wintering ground were to be afforested, then an interval of at least twenty-five years would have to elapse between the undertaking of each third part of the operations. The more quickly each block was planted, the

sooner it could be opened to deer, and the sooner the planting of the next block could be taken in hand.

"There is no great practical objection to even-aged blocks of considerable size, provided that these are not so large as to make it difficult to bring the area eventually into a regular rotation of fellings. Say that twenty years' fellings have to be made in an even-aged block, then the whole can be brought gradually to the provisions of the plan by anticipating or retarding the due date of each felling.

"Under this system the plantable ground of each deer forest could be brought under a timber crop in three operations at intervals of from twenty-five to thirty years. Once safe from damage the whole would be open to deer, except those parts which had to be fenced off for regeneration; taking seventy-five years as the rotation, the compartment aged nothing to twenty-five years, or one-third of the whole, would be the maximum fenced off at one time.

"With regard to sheep farms, the question is more difficult. At the present moment over a large part of the West Highlands the value of wintering is very greatly reduced by a strong growth of bracken, which makes it almost impossible for grass to exist on a great deal of the land which ought to afford the best of winter grazing. The improvement of this land by the regular cutting of bracken is a recognised fact. It is necessary to cut the bracken at least twice, or better still, three times the first year, during the growing season; in subsequent years the growth will be much weaker, and one cutting only in the season may suffice, with an extra cutting of all the stronger patches. This is already done in some cases by owners and tenant farmers in the interests of their stock. It is obvious that where the ground has been improved a larger stock can be kept, and in these cases it does not seem to be fair at the present time to suggest any reduction of the wintering ground by planting. But in the great majority of cases little or nothing is done, and it is probable that a fair bargain could be made by which assistance for bracken cutting would be given on condition that ground were given up for planting.

"After allowing say three years for the improvement of wintering, it is believed that as much as 10 or 12 per cent. of the total area of some sheep farms could be planted without any reduction of sheep stock—this percentage will of course vary

with the altitude and character of the farm. The most suitable subjects will be those on which blocks of not less than 400 or 500 acres could be planted—so that the whole area of the farm must be 4000 acres or more. Even so, great care must be taken in selecting the ground to be planted, so as to interfere as little as possible with the management of the sheep stock, and in particular to avoid running the plantation fences on lines which might increase the danger to sheep in times of heavy snow ; subject to these conditions, it may be possible to select areas adjoining the march between farms, so that blocks of 1000 acres or more could be planted in the case of two large farms, or 400 in the case of two smaller ones.

"Sufficient data are not at present available for a considered opinion as to the extent to which sheep could be wintered in plantations.

"In the older larch and pine plantations sheep are wintered successfully in many districts, but such plantations do not as a rule reach a high silvicultural standard of density of crop—in fact it may be said, the worse the wood the better the wintering. Open plantations of larch and pine provide not only shelter but a considerable amount of winter grazing ; larch plantations at forty-five years old or older will generally show a growth of grass, while pine plantations are apt to revert to heather as they become more open. Strictly silvicultural considerations prescribe under-planting in both cases, and that is quite incompatible with the wintering of sheep. It may be, however, that in our climate we can afford to relax the strict silvicultural rule of soil protection in favour of sheep farmers. Plantations of Norway and Sitka spruce and of Douglas fir, which are likely to become extensive and important in the near future, are of much denser growth at all ages than larch and pine, and are unlikely to afford any grazing worth speaking of up to the age of seventy to eighty years, at which they are likely to be utilized. Still, they are capable of providing excellent shelter at forty to fifty years old, in which sheep could be hand-fed in times of deep snow.

"There is one grave objection to wintering sheep in plantations, in the loss of wool where sheep come in contact with rough bark and snags of branches. This objection can be minimised by the removal of all dead branches from the lower part of the stems, but if these branches are not collected and burnt—

a laborious and expensive proceeding in large areas — the remedy may be worse than the disease.

"As to the age at which sheep could be admitted for wintering, the opinion may be hazarded that larch plantations would become available earlier than any other plantations—at the age of twenty-five to thirty years.

"Generally speaking, it may be said that the wintering of sheep on any considerable scale in plantations will involve the adoption of a less intensive system of silviculture than could be followed if sheep were excluded altogether. It may very well be true in Scotland that the loss due to this cause will be less important from an economic point of view than the corresponding gain to pastoral interests. Further, if plantations have a definite and considerable value for wintering, then, as soon as the first-planted blocks become available for sheep in winter, further enclosures for planting can take place on the same farm without reduction of the winter stock.

"Perhaps enough has been said to show that the whole subject is worthy of closer investigation than it has yet received."

Mr D. K. M'Beath then spoke on the "Relation of Afforestation to Deer Forests and Sheep Grazings," and said:—"One of the great questions of the day is afforestation. While all of us are directly interested in furthering a systematic increase in the production of timber in Scotland, there are, however, various interests to be considered, not to mention the very important matter of selecting not only the most suitable ground and situation for afforestation, but also the question as to what class of timber can advantageously be grown in a particular district. It is fundamental to the success of any general scheme of afforestation that so-called waste lands, be they deer forests or sheep grazings, should not be encroached on without full consideration of the various public interests concerned. In other words, no land should hereafter be afforested which would in any way reduce food production, and so cause an increase in imports; no crop must be grown at the expense of another.

"Afforestation must stand or fall on its own merits—it is hopeless to expect it to run in double harness with small holdings or any other such scheme. The position of the crofter-fisherman or fisherman-crofter, on the coasts both of the mainland and of the islands has long been an unenviable one to

himself and a disgrace to the nation; the creation of another variety, the crofter-forester, has therefore a certain risk with such experience of divided occupations. However, as will presently be seen, afforestation will give steady employment to a very considerable number of men, especially when compared with the depopulation which the introduction, towards the end of the eighteenth century, of sheep-runs admittedly made inevitable. The subsequent appearance of deer forests as rent-producing subjects did not appreciably affect the number of people on the ground.

"Without a preliminary survey of the ground presently under deer and sheep, nothing effective can be done in advancing the subject of this paper. Such a survey must be made by practical men who, combined with other forestry knowledge, are at home on the subject of grouse moors, deer forests and rough sheep grazings. The question of altitude is only one of the difficulties which faces the forester; situation and exposure are even more important. The situation must be chosen with reference to the ultimate transport of the timber; if too far removed from convenient sea or rail facilities the value of the timber will be affected to no small extent. It is well to bear in mind what was written in 1793, in *The Agriculture of Inverness-shire*, in connection with the famous old forest of Achnacarry: 'to purchase imported timber therefore is found to be cheaper, at least, it is preferred.' It may be a revelation to many to learn that over a century ago timber was 'imported' into the Highlands of Scotland.

"It may be taken for granted that we are on the eve of an economic change in the utilisation of land of whatever quality. Much has been written on the cattle-grazing system which prevailed in the Highlands for the greater part of the eighteenth century; it is now known to have been wasteful from whatever point of view one looks at it. Moreover, the cattle produced were but small animals and the price received for them must now be regarded as insignificant. Thereafter, the Border flockmasters invaded the Highlands offering such tempting rents that the landlords received them with open arms, while the people had to leave the country in great numbers. Sheep had their day; ultimately lairds were in many instances saddled with farms with heavy stocks which they had to take over at acclimatised prices and retain (borrowing the necessary money

at a high rate of interest), probably selling at a much reduced market value as no tenants could be found. Sheep are in a manner tied to the ground, and however often the tenant changes, the stock, owing to the inflated value, remains on the ground. It need scarcely be stated that this unfortunate situation arose from circumstances over which neither landowner nor flock-master had any control—the free imports of Colonial wool, followed by mutton. As was natural, landowners left with sheep ground on their hands looked about them, and gradually "shooting" tenants took the place of flock-masters, sheep-runs becoming deer forests. Deer-stalking became fashionable and rents increased accordingly, even much ground not well suited for deer being turned into forests.

"Deer forests have served their time, as did sheep-runs, but neither deer nor sheep will disappear from the land; the number of the former will be lessened, and much low ground formerly placed under sheep will again be ploughed. Deer are not considered to improve the ground on which they feed—certainly sheep do not. The bracken pest is laid by some authorities at the door of the sheep. In the old cattle-grazing days, the hoofs of the herds kept down bracken. There may be about two million acres of land at present under deer which should be transferred to grazing or afforestation purposes; as for sheep farms, many of them are of poor quality, with a consequent abnormal death-rate. Such ground, let in many instances at 4d. per acre, naturally invites, and is bound to receive, attention from foresters. In passing, however, let it be said that undoubtedly sheep added materially to the prosperity of Scotland, while deer too deserve well of the country. The shooting tenants raised the standard of living and comfort, spending money freely in various ways and giving employment locally as well as to men from a distance. Landowners and forests benefited by the liberality of lessees, permanent improvements being made in many cases. Certain lairds who let their forests applied no small part of their high rents to improving their properties, and wealthy landowners who occupied their own forests were the modern pioneers of afforestation. Hereafter it would appear that deer will be generally restricted to the higher hills; there producing such rents and food as could not otherwise be obtained economically.

"There are, of course, excellent examples of the value of

afforestation to deer forest owners, but many lairds are not, and have not been, in a financial position to plant trees to any considerable amount. Such will welcome any public scheme of afforestation as being of mutual advantage. The late Sir John Ramsden, proprietor of Ardverikie and Benalder forests, may be cited as the most prominent example of a tree-planting laird in the Highlands. He lived long enough to see, as one of the results of his immense expenditure, a great improvement in the weight and condition of his stags and also their heads. Shelter and feeding are the two essentials upon which quality depends; natural woods which afford deer shelter fall every year more and more into decay, in too few cases no care being taken to extend or replace them by judicious planting. Birch, alder, and oak saplings, of which many natural woods largely consist, are short-lived trees, and no young plants are growing up to replace them. Planting is expensive, and deer and rabbit-proof fencing is necessary to protect the young trees for from twenty to thirty years, according to situation, before the plantation can be thrown open to deer or sheep. Where birch, alder, and oak grow, larch will flourish. Land selected with care will yield revenue very considerably in excess of that returned by sheep grazing; one instance only need be detailed here. The rent received for a certain sheep farm, of which the present writer had personal knowledge, is £40 less £6 paid by the landlord for a supply of basic slag; the extent including 25 acres of arable land is about 2000 acres, requiring only two men for its maintenance. The landlord has also to bear the expense of maintenance of the buildings and fences, and pay rates and taxes. The tenant, like other sheep-farmers, has to winter his hoggs at a distance at an expense of from 8s. to 10s. per head. Close by this sheep farm are 45 acres of similar ground under wood, planted in 1874, which now yields as it stands £90 per acre. Surely this is an argument not to be gainsaid for increasing the area under trees; sheep can be much more economically produced elsewhere. Similar cases are doubtless familiar to all interested in the question.

"The low value of much sheep ground is also evidenced by the fact that much is let at 4d. per acre, whereas 14s. may be reckoned as clear rental from timber; as for employment, while a hirsal of six hundred needs only one man for its 2000 acres,

one man for each 100 acres is required where the ground is under wood. The capital value of much sheep ground in Argyll with suitable buildings thrown in varies from 10s. to 18s. per acre—could more be expected when the annual produce per acre is only 7 lbs. of marketed mutton, and from 5 lbs. to 7 lbs. of wool?

"There is a certain wastefulness and needless expense in the cutting up of timber. Why should the raw material be sent to towns for manufacture? Cut it up on the spot. There is generally no lack of water-power on the hillsides for the production of the necessary electricity. Numerous new uses are being found for timber in various forms; its value is bound to rise in the near future, for some countries will not be able to resume exporting to us."

Mr Galloway then read the following letter from Professor Somerville, who was unable to be present at the meeting:—"I should have liked to take part in the important conference on National Forestry, and to have said a few words on forestry education. In this connection one has to think of—

"1. *The Landlords and Factors.* The present generation is beyond the reach of class-room instruction, but they have educated themselves in a very remarkable way through the agency of books and periodicals, excursions, and meetings such as you are holding on Wednesday. I think that the way in which landlords have, in many cases, recognised the importance of forestry, and have made themselves acquainted with the technical details of silviculture, is very striking. In the past the prospective landlord or factor has not had much opportunity of making a systematic study of estate management during his University career, but I am hopeful that in future it will be recognised that such facilities must be provided so that a young man, who is destined to control land, shall have the opportunity of studying the fundamental principles of his life's work at a time when his mind is sensitive to educational influences.

"2. For *professional foresters* courses at universities and colleges are already provided to some extent, and these should be amplified and extended. For higher qualifications a higher standard of remuneration must be provided, and this attraction will, it is to be hoped, induce young men to give a longer period to preparation for their profession.

"3. Education for the rank and file of *working foresters* must, by means of local classes, be made easy of access. The large schemes of afforestation that are in prospect should be utilised as the training-ground, where, under skilled supervision, young men will gain experience in the best methods of performing silvicultural processes. The working forester is a vital factor in the success of afforestation, and too much consideration cannot be given to his training."

At the afternoon sitting Miss Macdonald, representing the Ministry of Labour, spoke on "Forestry Work for Women." She said:—"I should like to describe the experience we have had in placing women for forestry work in various parts of Scotland. The women can be employed under two conditions. First, they can enrol as National Service volunteers. Such volunteers get a free outfit provided; they get their fares paid to the place where they work; they are employed a certain time—as long as the farmer or employer requires them—and then they get their fares paid home or to another place of employment. In return for this, the workers agree to sign on for the duration of the war. If the employer sends them home, the girls get 2s. 6d. a day unemployment allowance for four weeks. If we cannot replace them in four weeks, they are allowed to sever their connection with National Service. Within these four weeks they must hold themselves in readiness to take up other agricultural work if required. During the summer there were a great many university students and others who were prepared to give their whole summer to agricultural work or forestry, and when the universities take up they go back to their classes. Edinburgh University closed in March, so that the girls could be free for agriculture or forestry during six months. It was arranged that these university girls, and those who were free only for the summer, could be enrolled under the National Service scheme if they wished. They would get all the benefits of the scheme except unemployment allowance, and they agreed that, while the war lasted, for such holidays as they got they would put themselves at our disposal to do agricultural work or forestry. The second condition under which women can be employed is as Ordinary workers; then they pay their own fares, and their wages are arranged between themselves and the employers, whereas under National Service the employer has to guarantee a minimum wage of 18s., except in the first

three weeks of training. If the employer thinks training is necessary, the Board of Agriculture for Scotland will pay the workers 15s. a week for the first three weeks. After three weeks the employer has to guarantee the wage of 18s. Some of the workers get 15s. a week and a free cottage and perquisites, that is, coal, light, and probably potatoes. I know from the experience we have had in placing university and other educated girls, that they are quite willing to work on piecework if the employer wishes it. Probably the idea of piecework is that the employees will work better. When educated girls are employed they can be trusted to carry out the work, and they do not require to be supervised as the regular working girls have to be. You can rely on educated girls. If you guarantee them a fixed wage they will work quite as well as if on piecework. With regard to the housing conditions at Achnacarry, where girls are working, an empty manse furnished by the employer was put at their disposal, and a woman was provided to cook for them. They got 15s. a week, with coal and light. In Roxburghshire there are six girls working, and they are housed above a stable in two rooms furnished by the employer. The girls have been working there since June, and are going to work for the whole summer. They cook their own food. They get one hour off in the middle of the day. They take their breakfast before they go out in the morning, take lunch out with them, and have dinner at night. They just keep regular hours the same as the men. I have had reports from the employer there, and he is entirely satisfied with the work the girls are doing. In Dunblane and Dunkeld the girls are housed in shooting lodges. All the reports we have had of the girls employed on forestry work, doing timber peeling, brushwood burning, or tree planting, have been satisfactory. Some of the medical students are willing to undertake forestry till the session resumes. We have other girls willing to work where required on forestry in Scotland."

The Chairman.—"With regard to the difference between piecework and regular wages, I would like to ask whether the advantage of piecework would not be that better work would be given, but that the women would not work more than they were physically fit for? If they have regular wages they are bound to keep regular hours, whereas under piecework they themselves would be the judges of what they would be able to do."

Miss Macdonald.—"I do not think there is anything to prevent girls working nine or ten hours a day if they are physically strong."

Sir John Stirling-Maxwell.—"It would be rather interesting to know whether any training is required."

Miss Macdonald.—"At the tree planting instruction was given to the workers who were paid for three weeks by the Board of Agriculture for Scotland. For the timber peeling they were not trained. The girls we had for timber peeling who were not under National Service were paid by the employer from the beginning, but I think in any forestry work it would be advisable to have them trained for the first three weeks."

Sir John Stirling-Maxwell.—"Would you think training better by the employer or at a separate centre?"

Miss Macdonald.—"We find it better to have them trained where they are to work, if it can be arranged. We have not had any girls thinning light trees."

A general discussion then took place on the various subjects raised in the addresses.

Mr Andrew Hamilton, Glasgow, said:—"I am very glad we have had this meeting on the West Coast. Although we have a large meeting to-day, we may have a bigger meeting later on. When we consider that Glasgow Fair begins to-morrow, I am afraid a good many people are out of town. I much appreciate Mr Carlow's way of putting it that we have to look for a very much bigger supply of pit-prop timber from this country than we have ever done, if we are going to maintain our position for a longer time after any outbreak of hostilities, or from any other stoppage of supplies. Also it has to be kept in mind, I think, that in the Baltic as well as other countries, forests are being cut much farther back from the sea and loading ports, and we will not have anything like the same conditions in the future as we have had in the past. Therefore it behoves us to look at this question not in any narrow-minded way. We come back to the question of £ s. d., and we have in this war seen that everything cannot be done with £ s. d. There are economic and national questions which are outside the cash column; and in that respect we have got, to my mind, to look around for a certain form of education, so that the people in the country will recognise forestry as a national necessity as well as a particular necessity, and, as our President and a good many

of us have been trying to do—we say we must interest to some extent the schools, and make the schools and the children the centre of forestry education throughout the country districts, for a gradual development of an industry which shall be commensurate with the necessities of the case. That is why I feel very strongly that we have to get at the education in the country. Round every school there should be forestry classes and a little forestry area. I do not think we will ever make much progress unless we make this a point in our educational system. We have in England and Scotland small school gardens. They have their crops, and at the end of the year these are cut down, but trees grow up during the pupils' whole time at school. I feel that in this way we could combine with education healthful and profitable labour, a labour which will be continuously developing from a small amount up to something very much larger, and when we get this afforestation we shall have growing round it other industries and other uses for the by-products of the forest that we have not yet touched."

Dr Borthwick, Edinburgh, said:—"What we as a Society would like to see would be some active support of silviculture by the railway and mining industries. I venture to suggest they might consider the possibility of taking some practical steps to ensure the afforestation of as much ground as possible, and in as suitable a position as possible, in order that pit-wood might be there as a reserve in the case of future necessities, without relying as we have done in the past on private individuals or upon the State. The combination of both is necessary. I think it would be in the interests of those big industries to do something practical to help."

Mr Broom, timber merchant, said:—"I would like to ask Mr Carlow a question. In your remarks, Mr Carlow, you said the mine-owners were always willing to consider home-grown timber, provided it could be produced as good and as cheap as wood from Norway, Sweden, and other places. I think we are all agreed that Scottish oak can compete very well with anything that can be grown in America. For waggon building I should say that our home-grown oak is very much superior, and I would like to ask if Mr Carlow would not consider—of course we cannot produce it at the price in the meantime—but it is a question for the mine-owners to consider—whether it is not advisable for them to extend their price a little further and

purchase home wood instead of foreign wood. As regards pit-props we cannot compete at the present time for straightness and cleanness, but we really have not tried in this country to grow timber so very extensively. I think if we tried it here we would be able to beat any Scandinavian country in that respect."

Mr George Fraser said:—"Mr President, I should like to support the view that we should try to extend education in forestry. All the members of this Society got a book written by yourself, which I think is a forerunner of a great future in educational matters in forestry. Mr Hamilton, who was the pioneer in the suggestion that a book should be written, got the idea from seeing children working in the nursery at Hairmyres. They were consumptive children, and the resultant benefit to them was unspeakable. They were expert at lining out trees. I think a time has come when some step should be taken in pioneer work for education in forestry. I would suggest that now that everybody interested in national welfare is approaching the powers that be, a deputation should go from this Society to the Secretary for Scotland. Besides the benefit to children we ought not to forget the heroes who have served us at the front. It may be said that they will not stick to forestry, but forestry would probably do for them what no other occupation can do. I am speaking from experience with over thirty discharged men we have had at Hairmyres. We have only one left out of these thirty, the others have all been able to go back to their own vocation, or have taken up other work which was more remunerative than forestry is at the present time. Special benefit was got by men who were gassed. We have also had consumptive patients working at forestry, and the result has been that they are serving their king and country to-day. Education intended to create an interest and love for tree life and out-door life generally is commendable. It is also commendable from a public health point of view. As regards Miss Macdonald's statement about the capacity of ladies for taking up this work, we have seven ladies working in the nursery at Hairmyres. Some of them are teachers who are taking this up as the result of reading your book.

"We should urge upon the Government the need of preventing waste among plants which are suitable for planting out in the nurseries in Scotland. So far as our afforestation scheme of the

Middle Ward is concerned, a good deal of blame for nothing being done lies with the Treasury. They refused to sanction our putting on to the hillside plants which we would have had to burn if we had not got consent. They refused consent on two occasions, but through the good offices of Mr Duncan Millar, M.P., we got an interview with Mr Montagu, and Mr Montagu admitted that his effort was going to waste £3 in order to save £1. We came away with the consent that we should go on with our afforestation scheme. He gave us a very small grant, but we hope to go back and get more. The result is that this spring we have planted 200 acres under our afforestation scheme. That has been done by two agencies—German prison labour and the schoolboys from Glasgow, and I think the manner in which it has been carried out is eminently satisfactory. About every tenth man among the prisoners of war—and we had over 300—is an expert forester or nurseryman. I am quite sure it is far better for these men to be employed than to keep them cooped up behind barbed wire. On the question of the quality of the labour I would say this, that the German labour has been very good provided you do not bunch up your men. If you keep them well spread out they work very diligently, but if you allow them to come too close together and to begin to talk and smoke, it is not economical.

"We have, I think, as a Society, been at every Secretary for Scotland, and we have been at other agencies. The Middle Ward national scheme was supported both by the Board of Agriculture and by the Development Commissioners. It was the Treasury that blocked it, and it has been passing through my mind that the idea of starting one department exclusively for forestry may be found in actual practice doubtful, because you will get one official pulling against the other. Forestry is intermingled with sport and agriculture, and will always be and can never be anything else, and I do say that if you could get a man at the head of affairs who has sympathy for all three, and has practical experience in all three, you will get far more readily forward. I beg to move that we appoint a deputation to ask for an interview with the Secretary for Scotland."

Mr Carlow, who was invited to reply to certain of the points raised in the discussion, said :—"One of the speakers mentioned the fact of the price of pit-wood being higher after the war than it was before. I think he is right there, and I think that forest

owners in this country may find a little comfort in that fact. I believe it is the case that in Norway, Sweden, Finland, etc., the forests near the sea have been pretty well exhausted, and now they have to go farther from the coast which means labour and transport which, I believe, in the future will raise the price of foreign pit-wood. There is the question of sea freight, which may be higher after the war than it was before. I agree that in the future, the price of pit-wood may be higher than the pre-war standard. The great thing is to get the pit-wood in equal quality. It is very important that it should be straight, clean-grown, and seasoned. If you, by your science in silviculture, can improve the quality of the trees, it will go a very long way indeed. At the present time, through shortage in supply, we have to accept timber which after the war, I should think, would not be accepted for pit-wood use. I would like to warn those who are supplying us just now that, after the war, when we have an available supply from abroad we will have to be more particular than we are now in accepting poor quality of timber. I refer more to straightness and cleanness. A great many branches are coming in which are rather crooked, and other things are being accepted which, in normal times, looking to the supplies from abroad, would have to be rejected. Another speaker mentioned the question of colliery companies helping silviculture by planting themselves, or assisting those who are prepared to plant, and that is a question which has not received any consideration whatever. I am afraid that the coal trade as a whole would be very chary about entering into such an unknown domain as the planting and the culture of trees. It is a matter with which practically all of us are unfamiliar. I am afraid it is a matter about which I cannot hold out very much hope of it being favourably accepted by the mining industry. It is, however, a matter which might be put before the coal trade collectively or individually for its consideration. At present I can make no pronouncement, nor do I feel justified in expressing my own opinion. One speaker spoke about home-grown oak as being superior to American. Our principal trouble with home-grown oak has been the crookedness of the trees beyond a certain size. If you want to get a pair of waggon trams out of a tree, it has to be a pretty big tree and 18 feet long in a straight line, which is rather hard to get in the home forests. I shall be very pleased if forest owners can grow oak

at home and compete with the American timber. If you can do it quality for quality, price for price—if it is a better quality, we will pay a better price."

The Chairman.—"May I ask one question? You have referred to the necessity of peeling and seasoning of pit-wood. Does that refer to the smaller sizes of pit-wood that only have a short life?"

Mr Carlow.—"We would like it all peeled and seasoned if possible. It is more convenient to handle. It is limited in weight, railway carriage is less, and it lasts longer in the mine, even though it be in a place where we do not wish it to last an exceedingly long time."

Mr Adam Spiers, Edinburgh.—"From what we have heard to-day I think the necessity of directing our attention to the production of timber in our own country is becoming more apparent than ever. Had the advice of the Arboricultural Society, freely given for over thirty or fifty years, been taken advantage of we would not have found ourselves in such a plight for timber at the present moment. I have no hesitation in saying that I think we can grow timber as well as any other country in the world, and a larger variety of it. It has been said that we can grow in eighty years what it would take 120 years to grow elsewhere in Europe. I am cutting a plantation at the moment, it is only from forty-five to fifty years of age, and the trees have from 25 to 35 cubic feet in them. The price was over £77 an acre, and I think the land would only be worth 12s. for agriculture. That is surely very good remuneration for timber-growing. The fault in this country is the patch-work forestry we have persisted in so long. If we would grow timber in sufficient areas, we need not despair of providing timber for the pits just as well as is done in Continental forests. Surely the area could be extended, and this would give enormous revenue to the country. I think the population engaged in the production of timber could be enormously multiplied, and it is surely people we want on the land. Why not produce more hardwoods than we do? Some members talk about oak. I do not say we produce the same fine cabinet-making oak in our country that we can get from America and other places, but for durability there is nothing can equal it. A waggon tram made of home oak will last twice as long as any American oak tram. American oak

has been very largely imported. I know one instance of American ash being sold in this city at 7s. 9d. per cubic foot. Neither American nor Japanese ash is as good as home-grown ash. We want to get the Government, or somebody powerful enough, to stimulate the national interest in afforestation, and until we can do something of that kind, the thing is hopeless. Patch-work forestry is no use in this country. Scotland is well adapted for growing timber on large areas, and I am certain it can be done. Sir Charles Bine Renshaw told us what the possibilities were. The requirements of the railway companies are enormous, and we can easily grow the timber. The home sleepers, given the same time for drying as the foreign sleepers take in transport, will last a longer time than any imported from other countries. What we want to do is to press forward and try to show to the country generally that forestry has been one of our most neglected industries, and is likely to continue so until some strong effort is made to prove to those who have the power to help us that it is a national asset, and one the country can never regret spending a great deal of money on."

Mr A. D. Richardson, Edinburgh, said:—"I was very much interested in Sir Charles Bine Renshaw's address. I think it was a most instructive address and conveyed a great deal of information of great value to foresters. In connection with Mr Carlow's statement on pit-timber, and especially what he said about oak timber for waggon building, I think there is no doubt whatever that what has been said about British oak is perfectly right. There is no foreign oak that will compare with British oak for durability. Of course, you cannot get the same long straight lengths out of it, as a rule, that you get out of American oak, but so far as quality goes, American oak is not in it. But the American oak is not the same oak at all. It is the American white oak, a different species, and it does not produce such strong timber as British oak. But if you compare home-grown oak with the same oak grown on the Continent, say that from Austria, a great deal of which came into this country in the form of scantlings, and for barrel making, you will find that the latter is very inferior stuff compared with British oak. Some years ago a great sensation was caused by some people in the south advocating the planting of the American white ash in this country instead of the British ash. That would be

a great mistake. The American ash is different from our ash. Most of the tools we import from America are shafted with American ash, and it has not half the strength of the British ash. There is another kind of timber that was mentioned to-day—that is, the Japanese larch. Mr Carlow said that the larch was used for certain purposes in the mines, and that they could get nothing which served the purpose better. I believe that for ordinary pit-timber there is no better tree to grow in this country than the Japanese larch. You can produce pit-timber in ten to twelve years quite well by means of the Japanese larch on certain kinds of soil, and it has this advantage that it will grow where other larch will not. Japanese larch so far is practically immune from disease, and I do not think there is any timber which would be better for pit purposes, because it answers all the pit-owners' requirements—straightness, cleanness, and strength. Of course, it is stronger than Scots pine. I was very much interested in Sir John Stirling-Maxwell's address, and in what he said about education. I was surprised to hear that there were as many as six teaching centres in this country as against one in France. If one teaching centre is sufficient for France, I do not see what we are doing with six here. I was also interested in what was said about the Forest of Dean School. We were in advance of England in the teaching of practical foresters. The teaching of practical foresters was started in Scotland before the Forest of Dean School was thought of, and it was modelled on the Scottish one. That was in the Edinburgh Botanic Garden. In the year 1888 or 1889, Professor Somerville gave a course of lectures to practical foresters, and after that a fully-equipped course was started there. I think that one very important thing in connection with forestry is the technical instruction of the working forester."

Sir John Stirling-Maxwell said:—"I cordially support Mr Fraser's proposal. It seems to me that it is only right that we should point out to the Secretary for Scotland, the very inferior position in which Scotland has been placed in regard to forestry during the past eight or nine years. From having been far ahead then we dropped behind, simply through the unfortunate arrangements which, perhaps, with the best intentions have been made for the change of forestry in this country. I think it would be very well if the actual state of affairs could be

brought home to Mr Munro, so that he might know in what respect he might help us."

The proposal was unanimously agreed to.

The Chairman, in proposing a cordial vote of thanks to Sir John Stirling-Maxwell for his address, said they were always glad to hear him upon a subject which he had made his own. He had always something interesting to say, and they appreciated his kindness in agreeing to open the discussion. Sir John Stirling-Maxwell, in acknowledging, said their thanks were also due to Sir Charles Bine Renshaw and Mr Carlow. A vote of thanks was awarded to Sir Andrew Agnew for presiding, on the motion of Mr Charles Buchanan, Penicuik, and the meeting afterwards closed.

2. State Forest Policy in America.

By Edgar C. Hirst, State Forester of New Hampshire (on leave).

Among the several forestry contingents which the great need for lumber in Britain and France have brought from Canada and the United States to carry on logging and milling operations on this side of the Atlantic, there is a civilian complement of over three hundred men recruited in the lumbering regions of northern New England and now operating ten saw-mills in north-eastern Ross-shire and south-eastern Sutherlandshire. The writer, who is in charge of these operations, has been asked to contribute an article to the *Transactions* of the Royal Scottish Arboricultural Society on state forest policy in America. An apology must be made at the start for the lack of reference material at hand, and the fact that various phases of the subject must therefore be treated in general terms. Most of the examples cited are from the north-eastern states, with which the writer is most familiar.

The most striking difference in appearance between the scenery in the uplands of New England and the Highlands of Scotland is due to the absence here, over large areas, of natural forest growth. The topography of the two regions is very similar, and the climate not radically different, although in New England there is more snow, steady cold, and lower temperatures.

The most important coniferous timber trees of New England are the white pine [Weymouth pine] (*Pinus strobus*) and the red spruce (*Picea rubra*). The former is found from near sea-level up to about 1500 feet elevation, and the latter from about 1000 to 3500 feet. These trees and the less important conifers, mixed with the characteristic hardwoods of the region—hard maple, beech, and birch—are found in all ages of natural growth from seedlings to standards. It is not uncommon for abandoned fields and pastures to restock naturally with pine or spruce, and to become covered soon with an even-aged stand of one or two species. It is generally recognised that our eastern states are being rapidly stripped of their remaining valuable forests. This is due to extensive clear cuttings often followed by fire. The growth of inferior hardwoods is increasing, while the valuable coniferous growth is reduced or prevented. While New England, and in fact the whole eastern United States, have a greater proportion of their area under forest than has Scotland, a large part of the so-called forest lands supports only small inferior hardwoods, with here and there scattered patches of valuable growth. The remaining valuable forest lands are being steadily reduced in area and productive capacity. To contrast briefly, it may be said that the forests of New England are natural, extensive, and, except over small areas, of low acreage value; while the forests of Scotland are cultivated, confined to small areas, and of high acreage value.

To understand the present forest policy in America, one must know something of the different kinds of forestry work performed respectively by the Federal and State Governments. The Federal Government owns some 160,000,000 acres of national forests in the western states, managed by the Forest Service, which employs a large corps of technically trained and experienced foresters. The national forests represent the remaining non-agricultural portions of the public domain, and since their administration was placed under the Forest Service some fifteen years ago, extensive fire-protection plans have been carried out in co-operation with contiguous private holdings, mapping and silvicultural studies have progressed, regulated timber sales are being made, natural reproduction of valuable species encouraged, and planting of waste areas undertaken on a large scale. These vast tracts of wild woodlands are being brought under proper silvicultural treatment as rapidly as

economic conditions and the demand for lumber in the different sections make it possible. Besides the practice of forestry, the other resources of the national forests are being developed. These include fish and game, hotel sites, roads, trails, and other recreational features, grazing, water-power, municipal water supplies, etc. The Federal Forest Service, in addition to managing the national forests, co-operates with the forestry departments of the several states in fire-protection and in various educational projects for the stimulation of private forestry. The general plan of such co-operative projects is for the officers of the Forest Service to outline the general policy, leaving the administrative details to the state officers. The National Government then usually matches dollar for dollar the amount which the State Government appropriates for the purpose. This co-operative feature has increased markedly the forestry work in the states. The Forest Service is also engaged in the purchase of forest land for the nation at the head-waters of navigable rivers in the eastern states. The efficient public work rendered by the Forest Service is due largely to its freedom from partisan political control, and consequent continuity of management in the hands of trained men. Prior to the organisation of the Forest Service and the establishment of the wild public lands in administrative units known as national forests, there was a great deal of political abuse and fraud connected with the management of the public domain, and much valuable public timber passed into private hands with little or no recompense. Such abuses have now been stopped. Orderly forest administration and sound economic development are progressing.

The forest problems of the different states, especially the group of north-eastern states, bear a closer analogy to those of Scotland than do the problems confronting the National Government. The forest policies of the several states are now in process of rapid extension and development. Beginnings were made thirty or forty years ago, but the greatest progress has been made within the past decade. In the eastern states, the first public recognition of forestry as a function of State Government took the form of appointing commissions to investigate the forest resources of states and report with recommendations to the legislatures. In the western states, particularly in the prairie region, the first state activities in forestry were in

offering prizes, bounties, or tax rebates to private owners for tree-planting. The results of the latter policy were small, and it has been abandoned in nearly all cases. The reports of the early state commissions, however, were of considerable educational value. Most of the men serving on these commissions did so without compensation, and gave their best efforts to bring to the attention of the people the importance of public forestry measures. We can hardly give too much credit to the pioneers in the movement. Many of their early reports are excellent state papers forecasting development that is just now beginning to be realised. Based on such reports a considerable amount of educational work was done by these state commissions, and by societies and associations formed for the purpose. In this stage of progress the forestry activities of many states may be said to have "hung fire" for a decade or more. The public interest in forestry, however, was growing, and gradually began to find expression in various laws for the protection of woodlands against fire, encouraging the planting of waste areas, the preservation of specific forest tracts and areas of attractive natural scenery, and finally for the centring of responsibility for such activities upon the State Government.

The first state forestry bureaux were subordinate to other departments of longer standing. In regions where there are large mining interests, forestry became a branch of the State Geologist's office. In others it was placed under the Department of Agriculture, and in all too many instances it was handled by politicians and placed where it could best serve their ends. During recent years, as its importance has become better realised, forestry work in many states has been removed from other bureaux and organised as a separate department. A number of states have established forestry departments in connection with the Agricultural Experiment Stations. Departments so established have generally proved successful, and this is likely to be followed in the large agricultural states where forestry is largely a problem of managing small farm woodlots. The activities of such a forestry department, being largely educational, can be carried on very efficiently in co-operation with general experimental and educational work in agriculture. The tendency, however, in states where large areas of non-agricultural land exist, is to centre all forestry work in a separate

branch of the State Government, co-ordinate with, and not subordinate to, agriculture, geology, and other departments. The advisory head of such a state forestry department is generally a commission or board appointed by the Governor. The commission is non-salaried, and is composed of men of attainment known to be interested in forestry. They appoint a state forester, who manages all work of the department, appointing and directing necessary subordinates. The commission meets periodically to advise the state forester on questions of general policy. The usual work carried on by such a department in a state of considerable forest resources are forest protection, afforestation of waste lands, acquisition and management of state forests, besides public educational work in all these branches. These will be discussed separately.

Forest Protection.

Most of the important timber states have now assumed as a public duty the protection of both public and private forests from fire, insects, and diseases. In nearly every region the first support of forestry by the state itself has been directed toward the prevention and extinguishing of forest fires. In a country like Scotland, where destructive fires in woodlands are rare, the importance of such work is difficult to realise. In the United States, however, every forest region has suffered heavily from fire. The damage has increased as cuttings became more extensive, since lumbering slash is seldom removed, and in most places constitutes a fire menace for from five to ten years after cutting. The causes of fires vary somewhat in different regions. In New Hampshire about 30 per cent. are due to mechanical agencies, such as railroad locomotives, steam saw-mills, and logging machinery; 65 per cent. are due to human agencies, such as brush burning, careless smokers, camp fires of careless hunters and fishermen, etc. (only 5 per cent. of these are incendiary); and 5 per cent. are from lightning. Fires running through mature timber generally leave considerable salvage, but in the young growing stands the loss is often complete. During the past eight years in New Hampshire the areas burned on different classes of land were as follows:—cut-over land (slash), 33 per cent.; unmerchantable growing stands, 40 per cent.; merchantable stands, 18 per cent.; grass and farm lands, 9 per cent. A considerable amount of

valuable natural reproduction is destroyed when slash areas are burned, and fires spreading from them to adjacent areas of good growth are responsible for the heaviest losses. It is to protect the young growth, or future timber supply, that fire-protection is carried on by the states.

The first step taken by every state has been the appointment of a forest fire warden in each town or community, whose duty is to summon help and to extinguish fires. At first local officials, such as selectmen or constables, were designated as wardens. The best results have been secured, however, where local wardens are appointed by and responsible to the state forester. In such cases the costs of fire fighting are generally shared equally by the local governmental unit (town or county) and by the state. To give quick notice when fires start, look-out stations are established on important mountain peaks, equipped with maps, telephone lines, and field-glasses. Look-out watchmen are kept at these stations during the dry months to report incipient fires to the local wardens. During periods of extreme drought, patrol men are employed to cover specially hazardous localities. The whole system is planned out and mapped in advance of the fire season, so that the fire force may be quickly increased or reduced as the weather changes. Railroad companies are required to use approved spark arresters on locomotives, to patrol their tracks adjacent to woodland during drought, and to pay the costs and damages of fires caused by them. Several states have begun restrictive legislation looking to the clearing of lumber slash. This has not proceeded very far, and is now required only where cuttings are made next to places of danger, such as railroads and highways. The fire-protection work of the states is encouraged by the Federal Government through the payment of money for maintaining look-out stations and forest patrol. The amounts paid to each state are apportioned according to the amount of timber to protect, the relative hazard, and the amount the state appropriates for the purpose. In most important timber regions co-operative associations of timber landowners have been formed. These associations assess their members on an acreage basis, in normal years about one cent per acre. The funds thus collected are used to augment the state system of protection within the region of the associated owners. Besides the administration of the fire laws and the management of co-operating agencies, the forestry departments

in most states carry on a large amount of educational work looking toward the more careful use of fire in woodlands.

The more serious diseases and insect enemies of forest trees are now subject to control measures by the states and Federal Government. Until recently the United States has had very inadequate plant quarantine laws, with the result that many serious insect pests have been introduced from abroad. Such an insect as the gypsy moth, brought into Massachusetts some twenty years ago, has done tremendous damage, cost millions of dollars of public money to combat, and at present is still increasing its area, although under partial control in the older infested regions. Recently the rapid spread of the white pine blister rust, introduced some fifteen years ago on German nursery stock, has become so serious as to threaten the commercial future of the best forest tree in the north-eastern states. Such pests may change the silvicultural practice in different regions from time to time, and ultimately eliminate trees of great commercial value. Experiments are already under way to determine the best substitutions which might be made from among European trees. The control of most tree diseases and insect enemies is handled by the scientific branches of the Federal Government and by the State Agricultural Experiment Stations. When a disease or insect becomes so bad that extensive restrictive measures involving police power become necessary, the work of control is often taken over by the State Department of Forestry, the research and scientific work being continued by the Experiment Station. In such cases a co-operative agreement is drawn up between the two departments, the Federal Government generally furnishing part of the necessary funds and outlining the general control policy.

Afforestation.

In spite of good natural reproduction of forests, the continued extensive and unregulated cuttings, together with fire, insects, and disease, have reduced markedly the areas of valuable timber in the older settled states. In the western states, where virgin timber is still abundant, the time has hardly arrived for strong public support of afforestation, but in the eastern and lake states, it has been realised for many years that timber was being removed much faster than nature reproduced it. Nearly all of these states contain large areas of non-agricultural land, most

of which now supports only scattered patches of fully stocked forests. The remainder has only sparse or inferior growth, or consists of waste land.

Efforts to encourage forest planting began about twenty years ago. The first method adopted was the establishment of state forest nurseries, from which trees were distributed to landowners at a fraction of the cost of raising them. Sometimes special inducements in the form of tax rebates were offered, but these have been generally abandoned. The state nurseries have been continued and increased in size, but the trees are no longer sold below cost. It has been found that such small inducements are not substantial, and do not lead to planting on any large scale.

The chief purpose of maintaining state nurseries is to encourage planting by the prestige of the state furnishing trees and carrying on educational and experimental work in planting. So far the planting of cut-over and waste land has not been done on a large scale by many large private owners. Farmers and small landowners, whose investment is small and not often a cash charge, have done more planting than any other class. Owners of summer estates have shown an interest in planting as a means of increasing the value of their properties, and offering a form of investment which requires little care during their absence. Municipal water companies and a few other corporations obliged to own considerable land have begun planting, in some cases rather extensively. A few lumber companies have started to reforest their cut-over lands. There is a growing interest in planting among all landowners, but in America the price of natural growth is still relatively low, and long-time investments such as planting offers are not attractive. Forest planting will not for many years become the common practice as it is in Scotland, and it is inconceivable that private enterprise there will engage in afforestation at a sufficiently early period to maintain an adequate timber supply.

Several states have endeavoured to educate private owners in planting by establishing numerous small demonstration plantations in different localities. In Massachusetts and New Hampshire this is being done in a unique way. These states, through their forestry departments, are authorised to accept deeds of cut-over or waste non-agricultural land. The state then plants the land and cares for the plantation. No purchase

price is paid for the land by the state, but the donor has the right by law to reacquire title to it any time within ten years, but not thereafter, by paying the state the cost of improvements plus 4 per cent. interest. A large number of small tracts have been thus acquired and planted. Several states have begun the purchase of large tracts of non-productive forest land for afforestation.

State Forests.

From the beginning of government in the United States until the latter part of the nineteenth century, the guiding principle of the public land policy was to get all the land into private hands as rapidly as possible. The desire to have the wilderness cleared, and to extend agriculture, justified the policy. During the latter part of the nineteenth century, it began to be realised that while the policy of rapid public land disposition might be the best one to develop agriculture, mining, and manufacturing, it was very questionable whether or not the continuation of this policy as applied to forest land would best serve the interests of a growing population. The theory of an inexhaustible timber supply was exploded by the diminishing cut in the great pineries of the northern states. It was seen there that the private owner, not being interested in a second crop of timber, made no provision for forest reproduction, and the forest industries vanished with the harvesting of the virgin crop. Gradually the present policy of national forests was developed, by which 160,000,000 acres in the west are managed by the Federal Service. In all this vast domain, any land suitable for agriculture is still open to *bona-fide* settlers.

The land policies of the eastern states in broad outline have been similar to those of the Federal Government. Nearly all the land in the thirteen original states belonged to the states individually, and not to the nation. Most of it was disposed of by sale or by grants for educational and other public purposes before it was of much value. During the past decade, the change in the land policies of the northern states has been very marked. The purchase by the Federal Government of national forests at the head-waters of our eastern navigable rivers has had a strong effect in arousing public interest in forestry, but the tendency in the eastern states is strongly toward state forests. Some of these states began acquiring forest land even

prior to acquisition by the nation. At the present time, eight of the north-eastern states have acquired a total of nearly 3,000,000 acres of forests.

At first the public impulse for the acquisition of state tracts was largely sentimental, and from a desire to prevent the lumbering of certain areas of particular scenic value. The protection of stream flow for water-power had a strong effect, but during recent years the value of state forests for timber production has been more fully realised. It appears inevitable that a period of land readjustment is setting in, and it is fortunate that state acquisition of forest land meets with public favour in those states where the timber supply is being so rapidly depleted.

The objects sought by state forests are four.

First.—The perpetuating of the timber and the use of non-agricultural waste land. A continuation of present conditions is not only rendering unproductive large areas of our non-agricultural soil, but coincidently is rapidly diminishing the raw material for lumber and wood-using industries. The acquisition of tracts of considerable size by the states will insure the planting of waste land and the maintenance of residual timber supplies so that forest industries may be continued. These tracts, by stablising the market for forest products, will in turn stimulate private forestry.

Second.—Education and aid to woodland owners and forest communities can be promoted in no better way. It is not contemplated to purchase any large proportion of the true forest soils. The general plan is to locate in the uplands tributary to every important timber market, a state forest of sufficient size to be an economical unit of management. Through co-operation in management with private owners in the same locality, these state tracts will have a strong influence on private forestry. The state tract in each forest community would become the centre for information, and its administrative officer would be able to advise and even make plans of management for a whole collective group of private woodlands, with special reference to the available markets. The present state tracts have interested and encouraged many private owners to begin silvicultural practice, and this interest needs simply to be organised and extended as the policy is carried out.

Third.—The protection of stream-flow for water-power is one

of the important reasons for not continuing to permit the unregulated denuding of mountains and hills. Coal, oil, and gas, especially in the eastern states, have increased in price very rapidly. More and more projects are under way for the impounding of water for power purposes. As this development proceeds, the afforestation of heavily lumbered mountain slopes by the state becomes of increasing importance.

Fourth.—The recreational features of state forests are by no means unimportant. The American public has always been accustomed to free access to all forest land for recreational purposes, but in the older settled states trespass regulations are being enforced more generally, and public pressure for recreational tracts will become strong just in the proportion in which the public is restricted in its opportunities for indulging this natural and wholesome desire. It is not planned to transform state forests into parks, but simply to provide for the use of such tracts by the out-of-door public by making good trails and roads, clearing observation points, protecting springs, and good camp sites, and leasing privileges under proper regulation.

The most encouraging fact about state forestry is that while state forests are serving the public in four important ways, they can also be made financially profitable through the sale of forest products. Nearly all public expenditures supported by taxation are of such a nature that the returns to the public necessarily take the form of better facilities for the living conditions, safety, and progress of society. State forestry offers an opportunity to return public benefits in a number of different ways, and at the same time provides a substantial revenue which can be used for other public purposes. It is fortunate that public sentiment in the United States is fast becoming crystallised on these points.

3. Deputation to the Secretary for Scotland.

REPORT OF SPEECHES.

On August 11, 1917, the Right Hon. Robert Munro, K.C., M.P., received a deputation of the members of the Council of the Royal Scottish Arboricultural Society in No. 6 Parliament Square, Edinburgh. The deputation consisted of the following gentlemen :—Sir Andrew Agnew, Bart., President of the Society ; Captain Sydney J. Gammell, of Countesswells, and Messrs W. H. Massie and Chas. Buchanan, Vice-Presidents ; Sir John Stirling-Maxwell, Bart., Hon. Secretary ; Mr Robert Galloway, S.S.C., Secretary ; Messrs Robert Allan, Polkemmet ; G. Fraser, Dalzell ; G. P. Gordon, B.Sc., Glasgow Advisory Officer ; A. Hamilton, Glasgow ; P. Leslie, B.Sc., Aberdeen ; G. U. Macdonald, Haystoun, Peebles ; J. H. Milne-Home, Langholm ; A. Morgan, Crieff ; A. D. Richardson, Edinburgh ; Charles Robertson, Colstoun ; A. Spiers, Edinburgh ; James Whitton, Glasgow—Councillors ; and Dr Campbell, member of the Society from Aberdeen District.

Mr Munro was accompanied by Dr Greig of the Board of Agriculture, and by Dr A. W. Borthwick, Forestry Adviser to the Board.

Sir Andrew Agnew said :—"Sir, I have to thank you on behalf of the Royal Scottish Arboricultural Society for consenting to receive this deputation, which consists of the Council of our Society.

"We have been anxious to have an interview for some little time so as to enlist your sympathy with the objects for which our Society exists—the promotion of forestry in Scotland—and your influence with the Government, in order to get on with the work of afforestation which has been so long delayed and which will be of such advantage to the country. We thought the present was a suitable moment to ask for an interview.

"The Committee which was specially appointed by the Government to advise them upon the question of State afforestation have presented their report, and important decisions must soon be taken. When these decisions are taken, we are very anxious that, through your influence, the claims of Scotland may be duly considered and recognised. I am bound to say that, in the past, they have been a good deal overlooked.

"I think there are at least two good reasons why Scotland should bear a prominent part in any scheme of afforestation. The first is that there is more ground available for planting in Scotland than in any other part of the United Kingdom, and the other is that 90 per cent. of the timber which is imported into this country from other lands is coniferous timber, and it is an undisputed fact that Scotland can grow that class of timber as well as, if not better than, any country in the world.

"You would expect, under these circumstances, that, when there was a question of increasing the amount of home-grown timber, some step would be taken towards it in Scotland; but that has not been the case. The two authorities who had it in their power to help have neither of them done anything worthy of the name. The Board of Agriculture in Scotland was set up for the express purpose of dealing with forestry as well as with agriculture. It has had an annual grant of, I think, £200,000, but practically the whole of that money has been spent on agriculture. The other source from which we had reason to expect substantial assistance was the Development Fund. But the Development Commissioners have dealt less liberally with Scotland than with any other part of the United Kingdom.

"I think, Sir, that the figures will probably surprise you, if you are not already acquainted with them. Down to March of last year the Development Commissioners had spent altogether £241,500 on forestry; but, of that considerable sum, only £17,500 has come to Scotland, while no less than £140,000 has gone to Ireland. In other words, although Scotland offers a wider field for forestry operations than England, Wales, and Ireland all put together, it has received only one-fourteenth part of the money which has been spent.

"Of the £17,000 which has been spent in Scotland, the greater part has gone to assist the scientific education of the higher class of foresters—an excellent thing if related to some general scheme of afforestation, but not of great use by itself. No doubt, a number of well-trained, well-qualified students have been turned out from the teaching centres, but what has become of them? When their training is complete, when they have received their degree or diploma, they find no career

awaiting them in this country, and every one of them has to go abroad to find employment.

"It is facts like these, Sir, which have made us anxious to see forestry placed under some new authority, where it will be treated not in a haphazard and disconnected way, but where it will be considered as a whole and developed in a wisely-ordered manner.

"I think, perhaps, it would be unfair to give you the impression that nothing absolutely has been done, although what has been done is very little; but, such as it is, you might like to hear something about it, and two of my colleagues here to-day who have taken a personal part in the work will tell you about it, and give you any information on the subject you may desire. I must not detain you by entering into any general question of afforestation. We have endeavoured to save your time and your patience by sending you a printed statement, which contains our views upon the subject. That statement was prepared at the request of the Forestry Reconstruction Committee, to which I have alluded, and was sent to them to assist them in arriving at their conclusions. We shall be glad if you will take an opportunity of reading the statement, and, when you have done so, I think you will see that the views contained in it are reasonable and practicable.

"I will refer to only one point on which we have laid considerable stress in that statement, and that is the question of a separate Department of Forestry. I have shown you how forestry has been a good deal neglected in the past, and how no progress has been made owing to lack of funds. But, besides that, there were several other reasons which influenced us in asking for a change. The first was that the Board of Agriculture will, in the future, be far too busy—be far too much occupied with problems of its own to be able to pay sufficient attention to the subject of forestry. The second reason was that forestry had become a very large question, and that it will afford ample work for a Department of its own. And still another reason was that forestry is a highly technical business, and that, if national afforestation is to be a success, it should be placed from the first under the control of men who have made a special study of the subject.

"I hope that these reasons may commend themselves to you, and that you will be able to support the proposals made. But,

if it should prove impossible to create a separate Department of Forestry—although we are not aware of any strong reasons against it—but, if it should be impossible, and it should be necessary for forestry to remain under the Board of Agriculture, then we would ask if you will obtain from the Government a fulfilment of the promise made six years ago. That promise was that forestry should be placed under a separate branch of the Board of Agriculture, with a separate staff and a separate fund of its own. The promise was made by your predecessor in office, Lord Pentland; I forget the year, but it was about six years ago. Unfortunately, he was called to other duties before he was able to carry it into effect; and, as a matter of fact, that promise has always remained unfulfilled."

The Secretary for Scotland.—"May I ask under what circumstances the promise was made? Was it in answer to a deputation?"

Sir John Stirling-Maxwell.—"It was a statement made in the House of Lords, in introducing the Small Landholders Bill, on 27th November 1911."

Sir Andrew Agnew.—"It was in the following terms: 'It is the intention of the Government that there shall be, under the Board of Agriculture, as an integral and vital part of its administrative machinery, a Department dealing with forestry which shall be developed as the needs of forestry may justify in Scotland.'

"I have called your attention to this statement of ours, because we are anxious that you should know precisely what our views are on the subject of afforestation. But, of course, we are aware that, when schemes of afforestation are being framed, the Government will not be guided simply by the views of any individual society. It will naturally be guided by the recommendations of the committee of very competent men whom they have themselves appointed to advise them upon this matter. The recommendations of that Committee have not been published and, therefore, I am not in a position to tell you how far they coincide with our views. Sir John Stirling-Maxwell, who is here to-day, may be able to tell you more upon that subject."

The Secretary for Scotland.—"I have seen the report."

Sir Andrew Agnew.—"While we cannot speak with regard to the recommendations of that Committee, we know the men who made the recommendations, and we are confident that, if their

views are adopted, we shall have a good scheme; and we are most anxious that in the discussion of any scheme the claims of Scotland may be duly recognised. I have spoken very generally because I feel that, in coming here, we have come not so much to urge upon you any special line of policy as to invite your personal interest in work which is of such great interest to us. It is the first time we have had occasion to wait upon you since your appointment as Secretary for Scotland, and it would be a great encouragement to us if we had your support, and I am very hopeful that we shall obtain it, because I am glad to see that you have already sanctioned a substantial grant of money to begin the work of afforestation on the estate of Borgie. I will not detain you any more just now. I have said that I have spoken in general terms, but there are two or three questions on which it might be desirable to be more explicit, and, with your permission, some of the gentlemen who have accompanied me to-day will deal with these."

The Secretary for Scotland.—"May I ask you one question? May I assume that the present view of your Society is in favour of a separate and independent Forestry Department, sitting in Whitehall, with a jurisdiction extending over England and Scotland, rather than a re-arrangement of the Board of Agriculture in accordance with the promise?"

Sir Andrew Agnew.—"Yes, it is; we consider that, in the circumstances, the Board of Agriculture is not able to deal with the question. It is so large a question that it really requires an independent Department to deal with it. That is our view, and we hold it very strongly. I now call upon Sir John Stirling-Maxwell."

Sir John Stirling-Maxwell.—"The subject remitted to me is the very large one of suggestions for the future. I shall try not to confuse your mind by making too many. In regard to administration, I can add nothing to what has been said by Sir Andrew Agnew. Of course the question is one of the first importance, and it is mainly to the faults of administrative machinery that our want of progress up till now is due. But, at the same time, one recognises that administrative machinery may be devised in more than one form, and all we desire is that a workable machine should be devised.

"I should like to add one or two rather brighter touches to Sir Andrew's narrative, which was necessarily sombre, having

so little progress to record. One is the fortunate fact that forestry has never hitherto got mixed up with party politics, and I hope that it never may. The other is that, while the Forestry Department of the Board of Agriculture in Scotland, through no fault of its own, has been unable to make progress since its appointment, we have every confidence in the man who is in charge of that Department. If Mr Sutherland were not now in France, he would be beside you, and, in his absence, I should like to say that we recognise that he has done, in face of great difficulties, everything he could to promote the interests of forestry. And the same is as true about Dr Borthwick, who sits beside you, and about all their staff.

"I should also like to say, although they have not been fortunate in making progress, that your predecessors in the Scottish Office have been helpful to us and desirous of improving the condition of forestry in Scotland. In that statement I wish to include Lord Pentland, although, from difficulties with which you are doubtless quite familiar, he was unable to carry out his intentions when the Board of Agriculture was established.

"What we feel about administration is this, that whatever is done the present deadlock must be got rid of. At present we have the nucleus of a very good forestry authority in the Board of Agriculture, but it has no money. The money, which is ample, is in the hands of another body, the Development Commissioners, of whom I would not like to say that they were totally ignorant of Scotland and forestry; but among them, I am bound to point out, you will find only one Scotsman, and he is not acquainted with forestry, and only one forester, whose experience was obtained entirely in India."

The Secretary for Scotland.—"Do you suggest that Sir William Haldane has no practical experience in forestry?"

Sir John Stirling-Maxwell.—"Not that I know of. That he has a wish to help forestry I do not doubt, but of his practical acquaintance with forestry I am not aware. We feel that this dual control is extremely unfortunate, and is one reason for so little progress being made.

"Mr Acland, who brought a fresh mind to the subject, has brought a great accession of strength to the cause of forestry in this country. I may just say that the practical outcome of it is that Mr Acland and his colleagues have come to the conclusion that it will be necessary, in the interests of safety, to

afforest between one and a half and two millions of acres. Of that, Scotland will have to provide a large quota. The actual work of afforestation will be done partly by the State, partly by municipalities—I may say I think municipalities one of the most hopeful means of afforestation—and partly by private enterprise ; and the practical suggestions which I venture to lay before you have in view all these methods of afforestation.

"The three things that seem to be most urgent are as follows:—First, the survey of the country in order that the best forest sites may be selected. It is from the point of view of this survey, perhaps more than any other, that it is desirable to have one authority for the whole country, in its early stage, because, if you have three authorities, the distribution of afforestation between England, Scotland, and Ireland will be a very difficult thing to settle. We feel that ought to be settled not on local claims, but entirely with a view to finding the best sites, that afforestation may be established with the least disturbance to other interests. Looking to the position of things in Scotland now, and the demand for a greater production of food—which must be reconciled with forestry—one feels that the invasion of sheep farms will be a much more difficult thing than it would have been before the war. And, therefore, one of the points that requires to be inquired into is—How much land now devoted to deer forest could be utilised for this purpose?

"Then another thing that seems to be an immediate necessity is the training of men—men trained for Scottish forest work having drifted away from this country—and the training of practical foresters. Our practical foresters in Scotland are very good, but they do require some more definite training, and it has been our misfortune in Scotland that there is no place where they could be trained. The Crown is, unfortunately, not in the possession of any woods of its own except the young plantations of Inverliever. It is a most pathetic thing that we should have a number of forest officers in Scotland, perhaps as deeply versed in forestry as any in Europe, who have never had any opportunity of conducting silvicultural operations."

The Secretary for Scotland.—"Does not that point to the desirability of having in your Forestry Authority, whether in London or here, two sides—one administrative and one practical?"

Sir John Stirling-Maxwell.—"What I was rather driving at

was that we are now compelled to add to the numbers of these officers before they have been able to put to the practical test the subject which they had been studying. Additions must be made. And so, for the training of additional foresters, it is necessary that we should have schools placed in suitable spots, where men could learn the practical work as well as the theory at the same time.

"There is one other matter that seems to be urgent, and that is the raising of plants with a view to the afforestation future of the country. The operation takes some time. We think the time has come when this question should be considered in a rather more comprehensive way than up to now. Up to now the Forestry Department of the Board of Agriculture and the corresponding authority in England have made considerable preparation for planting after the war. But we think the time has come when the whole position of private undertakings in this direction—trade nurserymen and others—should be considered. Many of the nurseries have been devoted to the cultivation of food crops, very properly; but we think the time has come for the provision of plants on a large scale.

"There is only one other thing I want to say before I sit down. The urgency depends not only on the question of developing forestry in Scotland; it depends also on the question of reconstituting our woods which are now being torn down. I have just been attached to a Department which has charge of that work in Scotland, and the position has been disclosed to me; and one can see that, if the war continues for a year, and, still more, if it continues for two years, the woods of Scotland will have been very largely swept away. It is one of the difficulties of the whole subject that for a knowledge of forestry one must almost always go abroad, and it is difficult for us even now to realise how great a part the forest can play in war.

"I would like also to call attention to the position of things in Belgium. Belgium is a small country, not very much bigger than Yorkshire, but its population before the war was the densest in Europe. It is denser than the population of England and Wales, and it is nearly four times as dense as that of Scotland, although Belgium contains no area so populous as Glasgow. In Belgium 18 per cent. of the total area of the country is occupied by wood; in Scotland, something under 4 per cent. The reason Belgium carries so large a population

is that its high districts, corresponding to our Highlands, instead of being bare acres of heather, are woods, while the valleys are occupied by the population working those woods, where they have their holdings and gardens. That seems to me an important thing, and I find it in Mr Seebohm Rowntree's extraordinarily interesting book, *Land and Labour in Belgium*. I wonder if you know it?"

The Secretary for Scotland.—"I do not know it."

Sir John Stirling-Maxwell.—"May I send you a copy?"

The Secretary for Scotland.—"I should be very grateful. I know his work."

Sir John Stirling-Maxwell.—"This book is most delightful, and there is a very good chapter on forestry. He estimates there that the wages paid in forestry in Belgium are no less than £400,000 a year, and they are therefore a very important part of the economy of the country. I have added those remarks in order to try, if I might presume to say so, to put you on the track of seeing what the real economic value of woods can be, judging the question as we all wish to do from a national standpoint, and not from that of the personal interest of any section of the inhabitants."

Mr Geo. Fraser said:—"As Chairman of the Middle Ward District Committee of Lanarkshire, I have been asked to deal with the progress and the effect of the Committee's work at Camps Afforestation and the Forest Nursery at Hairmyres. The extent and details of these schemes are already known to you officially. The Committee believe that by their efforts forestry has been popularised; and its great value as a factor in education, in the restoration of health, and in rural labour has been conclusively proved. I shall deal with these points in the order given.

"*Awakening Interest in Forestry.*—Watching children working in the forest nursery at Hairmyres suggested to members of this Society that every child should be taught to know what forestry is and what it means to our country. The result was the booklet entitled *Forestry for Young People*, so admirably written by our President, Sir Andrew Agnew. That in turn has resulted in seven ladies coming to work in Hairmyres nursery—three of whom intend to make forestry their profession, while other two are teachers, who came with the intention of equipping themselves for giving instruction in elementary forestry.

"The West of Scotland Agricultural College have placed 100 women in permanent employment in forestry. Already 42 students have expressed a desire to enrol for the College winter course, and of these 20 are ladies.

"These facts clearly show that in the West at all events, where forestry has been hitherto neglected, there is now a keen and growing interest in it The fact that two local authorities and two private owners have proceeded with afforestation schemes, notwithstanding the difficulties created by the war, appears to us to show that no good reason exists why the Government should continue to neglect forestry in Scotland as they have done. We submit that matters have now reached the stage when, in the national interest, forestry should be guided and stimulated by Government recognition and grants.

"*Forestry in Education.*—Forestry is an ideal study for children; it is within the scope of every scholar to do something in forestry; it has an abiding interest; it is health-giving; and is of great national importance. Our experience working with children in Hairmyres nursery justifies us in recommending that school forest nurseries ought to be established. We take the view of the American Forestry Association with reference to the school study of trees and forests. Whereas the child is the heart of society, the secret of permanency lies in its training through the medium of our public school system.

"What the Board of Education suggests with reference to gardening we claim equally for forestry.

> 'The material with which every student is concerned is so rich, varied, and interesting, and offers such opportunities of cultivating the powers of observation and reasoning, and the qualities of carefulness, that even within the limits of a school garden the study can be made educative in the fullest sense of the term.'

"As showing how wide the interest in forestry now is, an article appeared in the last volume of the Society's *Transactions* on the 'Chinese Forest Service.' The writer states:—

> 'We will take steps to interest our schools—public, private, and missionary—in forestry, and induce them to include something about forestry in the course of study.'

"At present, technical and other schools in Scotland specialise in advancing knowledge of the local industries. There are

classes for mining, for instance, but these never deal with the growing of timber, the only material that can safely be used for pit-props. We have no desire to deprive the scholars in the Highlands of a knowledge of the heavenly bodies as now taught to them, but we do plead that, in the interest of our nation, and especially in the interests of the Highlands, the children there should be encouraged to take a living interest in tree-growing.

"During the past few days we have heard much about the advance of agriculture—through education in its widest sense—in Germany, Denmark, and other European countries. What was said of agriculture in these countries could equally be said of arboriculture, and while we may say a good deal about agriculture in Scotland, all we can say of arboriculture is that it has remained entirely neglected.

"At Easter eighty schoolboys from Glasgow, assisted by German military prisoners, planted 200 acres of Camps afforestation, and at Hairmyres we lined out two million plants and prepared an acre of seed-beds.

"*Recuperative Value of Forestry.*—The primary purpose of the colony is to provide after care—training and treatment—for our tuberculous patients. Our experience satisfied us that our scheme might advantageously be temporarily used to benefit those broken in health by military service. Mr Barnes, who visited Hairmyres and Camps, shares our views, and through his efforts facilities for completing the buildings have been secured. About forty discharged men have worked in Hairmyres nursery, and everyone benefited greatly. Several of the tuberculous civil patients benefited so much that they are now serving in the army, passed for general service.

"Dr Macpherson, the resident physician at Hairmyres, has had a wider experience in the effect of graded labour, as a cure, than any one in the medical profession. In reply to an inquiry as to his opinion of forestry as a curative agency, he wrote:—'Emphasis might be laid on the marked physical improvement on the general health of the workers in the forest garden, and not merely the patients who, of course, also invariably derive much benefit. The work is as valuable a sedative in excitable cases as it is a stimulant to respiration and circulation in those convalescent from acute illness.'

"*Forestry in Rural Labour.*—We all admit, as first principles in forestry, that it will benefit agriculture, and our experience at

Hairmyres has proved that the blending of the two will (as in Germany) often solve labour difficulties in rural districts, in that foresters can come to the aid of agriculture at harvest and other times of pressure when forestry work is less urgent. It is an interesting fact that on an average every sixth man among the German prisoners knew about forestry—if not actually a skilled forester, as many of them are. In the question of combining forestry with agriculture, it is appropriate to quote from the Memorandum on *The Recent Development of German Agriculture*, by Mr T. H. Middleton, Assistant Secretary, Board of Agriculture and Fisheries:—

> '*The Assistance given by Forests.*—It is difficult to exaggerate the importance to the farmer of arable land of such industries as provide work for rural labourers in the winter months, and in this connection attention may be drawn to the benefit which German agriculture derives from the 35 million acres of land under forests; for woodlands provide much winter employment, and thus reduce the amount of the labour bill falling upon cultivated land.
>
> 'This combination of forestry and agriculture, the former providing winter and the latter summer employment, enables large tracts of poor land in Germany to support a considerable rural population. In Britain similar tracts of country are almost uninhabited.'

"The two subjects—forestry and agriculture—as shown by Mr Middleton, instead of being antagonistic, are co-operative in the strongest possible sense. Many discharged men who desire or who may for health reasons require to live in the country, and have no capital with which to stock a holding, would find in national forestry an ideal life.

"What has been and is being accomplished by ladies, by schoolboys, and by children at Hairmyres, conclusively proves that much in forestry can and should, meantime, be accomplished without in any way affecting the issues of the war, and without causing financial strain at home.

"Surveys for national schemes have to be made; seed-beds have to be prepared; seeds have to be gathered, sown, and cultivated; all of which work would be of unspeakable interest and value to many unable for military service, and to those who have suffered by service it may be the means of restoring them

to full life, or will, at all events, be a payment to account of all that is due."

Dr Campbell, Chairman of the Governors of the North of Scotland College of Agriculture, said:—"As representing the Aberdeen branch of the Society, I have been asked to make a short statement as to what the North of Scotland College of Agriculture has done in the matter of forestry on the estate of Craibstone. We purchased that estate in 1914 for about £19,000. One-half of that sum was contributed by the Development Commissioners through the Board of Agriculture, one quarter by the Scotch Education Department, and the other quarter was provided by the College from local sources. The estate extends in all to about 763 acres, and of these about 260 acres are woodlands. The estimated value of timber on the estate at time of purchase was £1800. Keeping in view our educational proposals in forestry, we, with the approval of the Board of Agriculture, sold a portion of the matured timber to the Home-Grown Timber Committee at a price considerably in excess of what we paid for the whole timber on the estate; and I may mention that the value of the unsold timber still remaining on the estate exceeds the price paid for the whole woods in 1914. One of the objects we had in view in purchasing the estate was practical training in forestry, and the development of forestry generally. We were of opinion that the district was specially adapted for a centre of a school of forestry. Not only is the larger area of ground already planted, and under wood, within the area covered by the North of Scotland College of Agriculture, but by far the largest area of plantable ground is also in the north. We have a *Degree in Forestry* in the University of Aberdeen, and we have two lecturers in forestry—one appointed by the College and the other by the University. I may be allowed to mention that our North of Scotland College is closely associated in its work with the University of Aberdeen, and I think this arrangement is beneficial to both institutions.

"In respect of all these facts, we considered from time to time comprehensive schemes drawn up by our lecturers in forestry for the development of our Forestry Department at Craibstone. In August 1916 these schemes were modified, and a new scheme was prepared and adapted to meet proposals put forward for the employment and training of discharged soldiers and sailors. I have a copy of this scheme now in my hands, but I will not

trouble you with details, as the scheme has not yet been proceeded with.

"As far back as 1914, the Governors of our College put forward a scheme for an instructional forest garden of 125 acres, but the Development Commissioners considered this an unnecessarily large area, and they recommended 30 acres as a suitable extent for the purpose.

"In May 1915 intimation was received from the Board of Agriculture that the Development Commissioners were prepared to recommend a capital grant of £250 and an annual maintenance grant of £100 for five years towards the establishment and maintenance of a forest garden at Craibstone, and this offer was accepted by the Governors. But in October of the same year intimation was received from the Board that, under the conditions then obtaining, the Treasury were unable to sanction the capital and maintenance grants proposed. Nothing further has been done in the meantime with regard to this proposed instructional forest garden. I may mention that Dr Borthwick quite approved of our recommendations in regard to the Forestry Department at Craibstone, and he shared our views that 30 acres is not a sufficiently large area for a forest garden.

"I have much pleasure in stating that through the initiative of the Board a forest nursery of 1½ acres was formed last year, and in the spring of this year another 1½ acres was added, thus making a nursery of 3 acres in all. There are now about 1½ million 2-year seedlings and about 1½ million 1-year seedlings in the nursery. We have agreed, at Dr Borthwick's request, to set apart sufficient suitable ground to line out the 2-year seedlings next spring. The whole community of the North of Scotland is deeply interested in this National Forest Nursery—the first of its kind in Scotland—and our Agricultural College, on educational grounds and otherwise, is greatly indebted to the Board of Agriculture for selecting Craibstone for this important purpose.

"Perhaps I may be allowed to say in conclusion, that the interest already taken in the Forestry Department at Craibstone by the North and North-East of Scotland justifies the Governors of the College in believing that the work now being undertaken by them will have a far-reaching and stimulating effect in improving the methods and promoting the prosperity of the Forest Industry in the North."

Mr A. D. Richardson.—"I have been asked to say a few words in connection with education, and the aspect of it which I have to deal with is the education of the practical forester. You, Sir, presided over a meeting yesterday in the Music Hall, at which a very able address was delivered by Mr Hall on this question, and I think if we just read 'working forester' for 'working farmer' in his address, the whole of the ground he traversed practically applies to the forester. At present there is not very much done for the practical forester in the way of technical education. He cannot avail himself of the courses at the colleges and universities because he has not the means. But there is a great demand for education of this sort on the part of working foresters, and these are the men who really have to conduct operations in the country at the present time. I may just mention what has been done in that connection. In, I think, 1889 Professor Somerville gave some lectures in the Royal Botanic Garden to working foresters. In 1892, an excellent organised course of instruction for foresters and gardeners was started there, the Government providing £150 to pay the lecturers. Practically the whole staff of the Garden after that time was composed of young men who were taken in for the purpose of going through this course. One-half of them were gardeners and the other half were foresters, and the course was made, as far as was practicable, suitable to both classes up to a certain point. There were sixteen of each to begin with, and the supply was in excess of the vacancies which were available for them. They did not learn any forestry, but they learned a good deal in connection with trees and shrubs. The course extended from two-and-a-half years to three years, and I may say that some of these men are now occupying positions of very great importance in forestry. Mr Annand, who is now lecturer in Newcastle College, was one of them, and a number of head foresters in the country, including the head forester at Scone, and on some of the other larger estates, are men who went through that course. They were paid the ordinary wages of the staff at that time and got their education free. The classes were held at night. Sir Ronald Munro Ferguson also provided for three years a bursary to enable practical foresters to attend classes in the University of Edinburgh. Three men went through these courses, and they also occupy important positions in forestry in Scotland, but, with these exceptions, very little has

been done for the practical forester. No doubt these men appreciate this sort of thing, and what has been done proves that if you provide technical education for the practical man you get very good results. I am not speaking of the men who go through the Universities and take forestry degrees, men of that sort have had to go abroad; but these practical men are the men we want in this country, and they are doing the work of forestry at the present moment. Of course, once we have a Forest Board set up with all the proper equipment, no doubt provision will be made for the technical education of these men, but in the meantime it would be a good thing, I think, if something could be done for them, and I have to ask your sympathy in the matter of providing something of this sort to enable them to tide over, so to speak, the interval between now and when the Board will be set up."

Sir Kenneth Mackenzie.—"We wanted to bring to your notice, what I think you know very well, the advantages that will accrue if in schemes of afforestation which may be embarked on after the war the question of small holdings is taken in connection with these schemes. I have little doubt that the country is practically pledged to a large number of small holdings being created after the war, and the destruction that has been caused by the war necessitates some Government scheme of re-afforestation. Whatever re-afforestation scheme takes place, it necessarily must begin in those areas where the soil is poor and not capable of great food production. We feel that when areas are selected for that afforestation, such areas should be selected as would admit of a body of small-holders being settled in each afforestation area. You know the country practically as well as I do, and you are aware that when cultivators have to deal with a poor soil and climate, and are at a distance from markets, it is practically impossible for the small-holder to make an economic living on that class of holding. But that class of holding does not require labour for every day of the year. The small-holder has many days in the year in which to earn wages, and we feel that if these small holdings were made in blocks of a sufficient size, and a school was established in connection with each block, that it would be very good for the small-holders, because they could get wages from the afforestation business every day when they were not employed on their holdings. It would further be extremely

economical from the afforestation point of view. You would only want one competent forester in charge and a very small staff, because the head forester would be able to get labour every day in the year, except at seed time and at harvest. If you could sympathetically consider that suggestion we should be grateful."

Mr J. H. Milne Home said :—"I have been asked to deal with the question of the taxation of woodlands, and in doing so I would like to make clear that in considering this question the Council of the Society are very anxious to state that they are not asking for any relief from taxation over and above the proper share which owners of woodlands should bear, but they do feel that, owing to what I might term almost an accident, the burden is considerably beyond what other sections even of the land bear at the present time. The views of the Council on this question are contained in the Memorandum which has been submitted to the Reconstruction Committee, of which I think you have a copy, but I should like to amplify those views.

"This question may be looked at in two aspects—the first is the valuation of woodlands and the second is the taxation, which is for the most part based on the valuation. In speaking, therefore, of the burden of taxation on woodlands in terms of a rate per £, I wish to make it quite clear that the poundage is the Valuation Roll figure, which is, after all, a supposed and somewhat artificial valuation, and which, even if it represents a fair average value for grazing, has no necessary relation to the profits, if any, derived from the woodlands.

"For the purposes of Imperial Taxes and local rates, woodlands are in some respects (but not in all) treated in the same way as agricultural subjects—that is, there is assumed to be a profit or income to the owner in the shape of a fixed annual rent, such as is received for a farm let to a tenant. That rent is in both cases liable, under certain deductions, to Schedule A, Income Tax, and possibly to Super-Tax also. The owners' rates are levied on the same valuation. But woodlands are also liable for all the occupiers' rates and taxes, even although it is obviously impossible to let woodlands upon terms in any way comparable to the letting of an agricultural holding. It thus comes about that not only does the owner of woodlands pay local rates as both owner and occupier—which is perhaps

defensible on grounds of convenience and expediency—but he also pays double Imperial taxes on a valuation which may not bear, and generally does not bear, any direct relation to the actual income received. It is this aspect of the question to which I desire to draw particular attention, and it is one which, at the present relatively high rates of Income Tax and Super-Tax, presses with extreme severity on the owners of woodlands, the assessable value for Schedule B, Income Tax, having been recently trebled apart from the increase in the rate.

"To come to actual figures, I think I am taking fair average figures if I state the combined owners' and occupiers' County Rates at 2s. per £, and the combined owners' and occupiers' Parish Rates at 2s. 3d. per £. These rates being directly levied on Valuation Roll rental can be readily calculated by anyone. With regard to Stipends, Heritors' Assessments, and Land Tax, these are burdens usually levied on the whole of an owner's lands in any parish, and, consequently, their incidence upon woodland must be merely apportioned. This can be done with considerable accuracy for any given case, although, owing to the wide variations in these burdens, an average is not so readily struck. Generally speaking, 2s. to 2s. 6d. per £ would be a moderate average, and I take the lower figure of 2s.

"Coming now to Income Tax and Super-Tax, I take the maximum rates of 5s. and 3s. 6d. respectively, because these are the rates applicable to the larger estates, and it is to the larger estates that we must look for the most extensive planting apart from State undertakings.

"After allowing for the deductions made on Schedule A assessable values, the amount of 8s. 6d. per £ is reduced to about 6s. 3d., but as there are no deductions under Schedule B the full 8s. 6d. is charged. The somewhat startling result is thus obtained that on the larger estates the present charge on woodlands for Income Tax and Super-Tax is equal to 14s. 9d. per £ of Valuation Roll rental. Adding to this the other local burdens I have mentioned gives a total taxation charge of 21s. per £ of valuation. In this calculation I have made no allowance for Death Duties on either the timber when realised or the land upon which the timber is growing. I might be asked what are the remedies that occur to any one familiar with these figures."

The Secretary for Scotland.—"I was just going to put the question."

Mr Milne Home.—"And if I might venture to anticipate, I would like to deal with it under three points; I put them forward as being suggestions that occur to me, and I would not like to make the Council necessarily responsible for them.

"1. With regard to local rates, the provisions of the Agricultural Rates Act should undoubtedly be extended to woodlands, so that the occupiers' rates would only be charged on three-eighths of the valuation. It is difficult to see any grounds upon which the distinction at present made can in fairness be justified or continued.

"It may perhaps be argued that the whole basis of valuation is different between agricultural land and woodland, and that consequently the latter has no right to claim the benefits of the Agricultural Rates Act. To this argument I would reply, that if an owner has a sheep farm in hand he gets the benefit of the Act, but if he plants that same land he loses the benefit of the Act, without any reduction or alteration in the valuation. This, I think, conclusively proves the injustice, and must act as a deterrent to planting.

"2. With regard to Income Tax, the double assessment under Schedules A and B should be abolished and assessment made under a single schedule only. It is true that assessment is now optional under Schedule D instead of Schedule B, but the period on which the profits are to be calculated—three years—is much too short, and would in many instances result in even greater injustice than the present system.

"It is especially difficult for any one at the present time to take the option of Schedule D, because in response to the urgent national demand nearly every owner of mature timber has been making heavy fellings, and consequently would be called upon to pay Income Tax on the value of that timber—an exceedingly onerous burden. It may be perhaps asked why, if the owner is receiving this money, he should not be asked to pay Income Tax upon it. My reply is that the sum so received is capital and not income at all, and that the owner and his predecessors have paid annual Income Tax in respect of the profits from the woodland where the timber was grown for a period of perhaps seventy years, over which period there have been few, if any,

receipts. To levy Income Tax on the final crop is, therefore, to charge the tax twice over.

"The choice of Schedule D as a means of assessment for all new plantations as 'separate estate' may be a means of relief which will eventually be effective, but meanwhile its effect must of necessity be almost negligible. The Super-Tax would, of course, follow the Income Tax assessment.

"3. Recognition has been made in recent years of the inequity of charging Death Duties over and over again on the same growing timber, and duty is now charged only when timber is sold, and that subject to certain deductions for out-goings. The question is still somewhat obscure, however, and most landowners do not really know where they stand. It would appear simpler and likely to occasion little loss of revenue if Death Duty on timber was entirely abolished.

"The only other point which I think relevant is that of valuation. There has been considerable inquiry (owing to the trebling of the Income Tax assessment) into the valuation of woodlands in the last two years, and it would be very helpful if some definite rule regarding the valuation of woodlands could be laid down. The law is very uncertain. Assessors do not know where they are, and I think some expensive test cases may be necessary. There is considerable controversy as to the meaning of the words 'land in its natural state as pasture,' and if it were possible to clear up the point I think it would assist in promoting afforestation by private owners. I would repeat in closing that I think, so far as I have spoken on behalf of the owners of woodlands, they do not ask that they should escape their fair share of taxation, but I think you will recognise from what I have said that through an unfortunate chance in the incidence of Imperial taxes and local rates they are at present carrying rather more than their share in paying 21s. in the £ on the valuation. That is a distinct discouragement to new planting, because if an owner takes ground under agriculture and plants it, he at once comes under a heavier burden of taxation in doing so."

The Secretary for Scotland.—"I am very grateful to you for coming here this afternoon to see me, and for giving me so much valuable information. I apprehend from more than one observation made in the course of our meeting that your purpose in

coming was rather that I should listen to you than that you should listen to me. In other words, you desire that in the days of my comparative Departmental youth I should be fed with the true milk of the word. Bearing that in mind, the observations I shall address to you will be exceedingly brief. I do not know that I need assure you—I think it is probably unnecessary to assure you—of my interest in this subject. I can claim not only to be interested in forestry, but to have a little knowledge of it—very amateur knowledge, which, having regard to what Sir John Stirling Maxwell said about Sir William Haldane, will probably be regarded as really worthless. At the same time, as Sir Kenneth Mackenzie will remember, both he and I know a good deal about a county—Ross shire—which in the days of my youth took a leading part in forestry, and I do not think it would have been possible for any one brought up as I was for many years in that county, and associating, I may add, from time to time with Mr Munro Ferguson of Novar, as he then was, to escape taking a certain interest at least in the subject. His enthusiasm for silviculture was contagious, and I am not at all sure that I escaped the infection. However, I quite recognise, apart from the interest of the subject, its supreme importance. I am at one with you there. I quite recognise the possibility of retaining, or perhaps I should say regaining, the supremacy in forestry which Scotland at least in the past enjoyed, and therefore the question really resolves itself into one of ways and means. We are agreed, all of us, with regard to the object in view, and, therefore, it resolves itself into a question of how that object can best be achieved. Well, now, when you are considering ways and means, there are two matters of importance—the one machinery, and the second policy. As regards the machinery by which our common object can be attained, two suggestions have been made. The one suggestion is that there should be an independent and separate Department of Forestry established in Whitehall with jurisdiction in England, as well as in Scotland, and that that Department should take full and exclusive control of forestry. Well, that is a very important proposal which deserves, and which I doubt not will receive the very fullest consideration. I am not at the moment prepared to say whether I assent to or dissent from the proposal. I have not had an opportunity of studying it with sufficient care to enable me to pronounce a final

opinion on that subject, and you will not expect me to offer one to-day for the very simple reason that the matter is beyond my jurisdiction, and that the proposal of a State Department of that kind will have to be considered by all the authorities interested —and there are other interested authorities beyond the Scottish Office and the Scottish Board of Agriculture. In all probability I should think the matter will have to be discussed by the various authorities interested, and then possibly decided by the War Cabinet. At any rate, it would be obviously futile and foolish on my part to presume at this stage to offer a definite opinion on the matter. All I can fittingly say, I think, is that the view you have expressed is one which I am bound to bear in mind, and to transmit to the proper quarter when the time for discussion arrives. The other suggestion, so far as machinery is concerned, is of a more modest and intimate character. It is really that the Board of Agriculture in Scotland should be to some extent remodelled, and that there should be a separate Department of Forestry with a separate staff, and separate duties, and a separate fund. That proposal, I understand, was made by Lord Pentland as far back as 1911, and it is well worthy of consideration, and I shall certainly deem it my duty to consider it. I have already considered it, I may say, although not in detail. But there again it is obvious that that proposal dovetails into the other, and that you cannot reach a determination on that more modest proposal until you have weighed the pros and cons of both. The matter is beyond my sole jurisdiction, but I will only say that the two proposals deserve and will receive full consideration by those who have a right to consider them.

"There is no doubt, as bearing on that latter proposal, that in the past there has been complaint with regard to the progress which forestry has made in Scotland under the charge of the Board of Agriculture, but it is fair to remember two things; first of all, that the chief official in charge of forestry—I mean Mr Sutherland—was only a part-time official, who had many duties of an onerous character to discharge as Commissioner for Small Holdings; and, secondly, that there was quite insufficient finance provided, as I humbly think, for the purpose of carrying out extended and suitable forestry operations. Now the mere fact that these two drawbacks existed in the past does not seem to me by any means conclusive as to what can be done

under the auspices of the Board of Agriculture in the future. But there again one is dealing with a matter which will have to be fully discussed in relation to the other proposal. Well, now, the second thing, when you are considering ways and means of achieving the object we all have at heart, is, What policy shall be pursued in order to attain that end? There, Sir John Stirling-Maxwell has furnished me this morning with very valuable suggestions, if I may say so, valuable not only in that they come from him, but in themselves as well, and all I can say with regard to that matter is that I shall consider the suggestions very carefully, and see whether effect can in the future be given to them. Then I have had a suggestion from Sir Kenneth Mackenzie which I was glad to hear. He referred to the alliance between forestry and agriculture. That is a view I have always taken and publicly expressed, and it is receiving effect at the present moment, as all of you know, in Borgie, in Sutherlandshire, where a very useful experiment in that direction is being conducted. There was another proposal for the future from Mr Milne Home about taxation, which he supported in a speech which would have done credit, if I may say so, to any experienced lawyer, and which I, as a lawyer, found a little difficult to follow. But there you are dealing with a subject which requires legislation, and, so far as legislation of that type is concerned, I am afraid that we shall have to wait for a little time before it can be put through.

"Apart from policy in the future, I was glad to hear of what has been done in the present. I was glad to hear of the operations in Lanarkshire, and also to listen to what Mr Richardson said about education. I am entirely with you in viewing this as an urgent matter which cannot wait till after the war to be dealt with. There are many important things to be done after the war, but in some of its aspects I think the forestry problems of to-day are so urgent that the sooner they are tackled the better. I spent this day week in the train, having left London on Thursday night for Wick—and as I travelled North I was very much struck with the number of trains I met hurrying past, long trains of trucks, and every truck containing wood, and the other side of the picture was to be seen on the hillsides as one passed along, bare and bleak hillsides, formerly covered with trees. I think even that picture in itself was sufficient to convince anybody of the urgency of the problem of afforestation to-day

in Scotland. I did not require to be convinced, but if I had required to be convinced, I think these two sights alone would have convinced me. I am aware that there has been something resembling a deadlock in the past in forestry. I do not seek to apportion the blame, if any, for it, but I do say to-day that it will certainly not be my fault if some progress is not made, and made at an early date."

Sir John Stirling-Maxwell.—"I did not intend to attack Sir William Haldane's reputation as a forester; we all know his interest in the subject, and I am quite sure he knows more than I do, but what I meant to say was that I did not envy his position on the Development Commission as one of the two representatives of forestry among a large number of colleagues, and I was rather contrasting the qualifications of the Development Commission as against an expert Department dealing with that subject alone."

Mr C. Buchanan, in moving a vote of thanks to the Secretary for Scotland, said he was quite certain Mr Munro would do his best in the interest of the nation.

4. Forestry Reconstruction.

By Colonel STIRLING of Keir.

The report of the Forestry Sub-Committee of the Reconstruction Committee was completed in May 1917, and in the interval between its completion and its publication there has been ample time for its consideration by the Government, in spite of the very large amount of urgent work in all departments at the present time; a circumstance which gives great importance to the decision to publish it.

The present report differs from several predecessors in many ways, and perhaps most notably in the conditions in which it was called for. Other reports were of the nature of suggestions for the development of forestry to be considered at leisure; the present report embodies a plan for dealing with an emergency which is with us here and now, and, whatever its fate may be, it is at least unlikely that it will end like its predecessors in a niche in one of those official columbaria where the dust gathers thick upon the urns containing the ashes of still-born or strangled schemes of improvement. Mr Acland and his colleagues have

been fortunate in the circumstances in which their labour was undertaken, circumstances which compel action of some kind to be taken. They were also fortunate in the fact that a great deal of spade-work had been accomplished by previous committees in the same field, and, therefore, they were independent of the necessity of calling witnesses. While they were at work, they had before their eyes the daily depletion of existing woods to meet the urgent needs of the war and of industry, and the disquieting fact that in spite of the great consumption of home-grown timber, no means were available of making an estimate of our remaining resources or even of gauging accurately the rate and volume of wastage.

Only recently, in answer to a question put by Sir John Fleming to the Secretary of the Board of Trade in the House of Commons, the Department admitted its inability to give the acreage of coniferous timber cut in England, Scotland, and Ireland during the war, and an estimate of the acreage standing before the war, and added that the labour of obtaining the figures asked for could not be undertaken at present. It is only fair to the Board of Trade to say that that timber supply had at that time only lately been transferred to the Board from the War Office.

But the fact that such an answer had to be given to an enquiry concerning a vital industry shows very clearly the need of an efficient department of forestry. Such a department would not only have been in possession of the information required, but would itself have been able, with some temporary increase of staff, to undertake the organisation of the Home-Grown Timber Supply during the war. It should be said that every effort is now being made, under the Scottish Branch of Timber Supply, to collect statistics of vital importance both to an estimate of our existing resources and of future possibilities. Hitherto any statistics as to the volume of timber grown and rate of growth have been collected by private individuals, and cover a relatively very small proportion of our woods, and it is very satisfactory that an endeavour is now being made to collect these statistics, the foundation-stone of scientific forestry, before certain classes of wood have almost or entirely disappeared. The report gives 100,000 acres as the best estimate which the Sub Committee have been able to form of the total area clear-felled during the war up to April 1917. This estimate is already out of date, and it must be remembered that there is every inducement to fell

the best areas of mature timber, and that the urgent demand for pit-props has led to the sacrifice of immature and promising woods, while at present we have no means of estimating the extent occupied by the various age-classes, or even of distinguishing between areas with a normal growing stock and those in various stages of depletion or occupied only by worthless scrub.

The report is admirably arranged: Part I. gives a concise and clear statement of the position of forestry in the United Kingdom; of national requirements in timber and the sources of supply; it also gives a summary of the experience gained in time of war, and an exposition of the case for adopting an adequate forest policy for the United Kingdom. Part II. gives the forest policy recommended. This can be best summarised in the words of the Sub-Committee to be found on pages 4 and 5 of the report, from which the following paragraphs are taken:—

"(5) In order to render the United Kingdom independent of imported timber for three years in an emergency, it is necessary, while making due allowance for an improved yield from existing woods, to afforest 1,770,000 acres. Taking eighty years as the average rotation, we advise that two-thirds of the whole should be planted in the first forty years. We consider that the quota to be planted in the first ten years should, in view of the initial difficulties, be limited to 200,000 acres, of which we advise 150,000 acres should be planted by the State and 50,000 acres by public bodies and private individuals assisted by grants, or by co-operation between them and the State. The area to be planted by the State in subsequent years may be reduced in the same degree as private individuals come forward to undertake the work.

"(10) We estimate the cost for the first ten years at £3,425,000. It may be necessary to invest £15,000,000 altogether in this enterprise during the first forty years. After that time the scheme should be self-supporting. The financial return depends on prices, wages, bank rates, etc., which are difficult to forecast. Forests are a national necessity; the country must have them even though they yield less than the current rate of interest on the capital invested. The whole sum involved is less than half the direct loss incurred during the years 1915 and 1916 through dependence on imported timber.

"(8) The first essential is a Forest Authority equipped with

funds and powers to survey, purchase, lease and plant land and generally to administer the areas acquired, with compulsory powers to be exercised, when needed, after due enquiry and the award of fair compensation. The care of forestry, now divided among several departments, should be centralised in this body."

The report is signed by all the members of the Sub-Committee, subject to reservations by two of its members. Alone of his colleagues Mr Bromley, of the Treasury, is not convinced of the necessity for creating a new Central Department of Forestry; and he reminds us that the Board of Agriculture for Scotland was specially charged with the promotion of forestry in Scotland as one of its most important duties, a fact which, perhaps, those of us who happen to live in Scotland may be excused for having forgotten.

Lord Lovat, on the other hand, sees in the record of the Scottish Board of Agriculture with regard to forestry a very convincing argument for a new authority, and wishes to lay particular stress upon the importance of this part of the recommendations of the Sub-Committee. Signs are not wanting that some controversy will be aroused by the recommendation of a single Forest Authority. There have been letters to the *Scotsman*, pilgrimages to St Andrew Square, representing farmers and factors, to protest against the removal of the control of forestry from Scotland; in the case of the deputation from the Chamber of Agriculture, the pilgrimage was made before the publication of the report, to request that silviculture should remain under the fostering care of the Board of Agriculture for Scotland.

It is always fatally easy to get up a cry that Scottish interests will suffer by a change in administration, and many patriotic people without any special knowledge will always be ready to join in the cry. But they should first examine the facts for themselves. The report establishes beyond the possibility of doubt the fact that Scottish interests in forestry have suffered under the present administration, when the progress in England and Ireland is compared to the stagnation in Scotland. And to what does the recommendation of the report amount? The ultimate control of forestry in Scotland is at present not in Scotland but at Dover House, Whitehall. The report proposes to transfer the ultimate control from Dover House, and from a

minister already overburdened with a multiplicity of cares and duties, to some other office in London where an *ad hoc* authority will be presided over by a minister able to give his whole time to the administration of silviculture. Separate branches of the department will be established in England and in Scotland, and it is probable that the Scottish branch, in view of the greater field for development in Scotland, will be the more important of the two. It will be staffed by Scotsmen and run on Scottish lines. Where is the injury to Scotland in this proposal? The Scottish members of the Sub Committee were unanimous in recommending it, and it has the support of the great majority of competent and independent opinion in Scotland. It will be very unfortunate if any serious controversy should be raised over a recommendation to which the Sub-Committee attach great importance, and from which the only dissenting voice on the Sub-Committee was that of one who is neither a Scotsman nor an expert in silviculture.

The methods by which the report proposes to deal with the actual work of afforestation are neither heroic nor timid. The plan of the first ten years' work is laid down in some detail. Two hundred thousand acres of new planting and 50,000 of replanting are to be undertaken in that period; it may, perhaps, be objected that 50,000 acres is not a large proportion of the area which will have been felled during the war, but the danger from insect pests on felled areas will be much greater than on new ground, at all events for the first half of the ten-year period, and therefore it is a prudent policy not to force the pace of replanting. Of the 200,000 acres of new ground, it is contemplated that 150,000 will be planted by direct State action on purchased or leased land, and that 50,000 acres will be planted by private or corporate enterprise with some assistance from the State. State assistance to private enterprise is looked at askance by some people. Those who have doubts on the subject will do well to weigh carefully the arguments set forth in the report, and the methods proposed by it.

No attempt is made in the report to allocate between England and Wales, Scotland and Ireland, the relative amount of the total area to be afforested, the allocation being left to the proposed Forest Authority. It is, however, recorded that the experience of the war has shown that military as well as industrial considerations demand that timber supplies should not be concen-

trated too much in one country or in a very limited number of districts. We may presume that it is not intended that this rule should be applied too rigidly; taken too literally it would come into conflict with the principle that land should be put to the highest economic use of which it is capable. In those districts of Scotland where the land is too poor and too steep and the rainfall is too heavy to allow of successful agriculture, and where even black-faced sheep cannot be wintered without heavy loss, silviculture may be the highest economic use of the land, and the only one capable of making it support a larger population than at present. It is only reasonable to suppose that afforestation will eventually attain its maximum development in these districts.

The time and space at our disposal do not allow even of an attempt to give an analysis of the report, but no analysis however complete could be a satisfactory substitute for the reading of the report itself. It deserves the most careful study, not only by all who are interested in silviculture, but by all those who are interested in the development of the natural resources of the country for the service of industry in time of peace, and for national security in time of war.

5. Memorandum on the Classification of Standing Timber.[1]

(*With Plate.*)

By P. Leslie, B.Sc., University of Aberdeen.

When estimating the contents of an area of standing timber, the task of the valuator, whether he is acting on behalf of the seller or the timber merchant, is greatly facilitated if the trees have been graded into four or five classes. To the experienced forester the grading of the trees in this way is usually not a very difficult matter, and no callipers nor other instrument adapted for the purpose may be required, but often on small estates, where a trained forester is not in charge of the woods, the ground officer or other employee entrusted with their supervision may be at a loss how to proceed with the classifying of the trees for valuation purposes, and a callipers may be a necessary

[1] Prepared at the request of the Board of Trade Timber Supplies Department.

accessory if the classification is to be carried out in a satisfactory manner.

One of the best instruments that we know of for classifying timber of fairly large dimensions for the purposes of sale is the Seafield gauge. This instrument has been in use on the Seafield estates for a long period, having been used when Dr James Brown, the author of *The Forester*, was manager of woods on the estate, and also, it is believed, before his time. The gauge is essentially a set callipers, with the two principal arms ($a\ a_1$, $e\ e_1$), which are about 14 inches in length, placed at a distance of about $13\frac{1}{2}$ inches apart, and a number of arms situated at intermediate distances, as shown in the accompanying figure (Plate 1), reproduced from a photograph of Gauge No. 2.

The distances between the arms, which it will be noticed decrease in length from *e* to *a*, are as follows :—

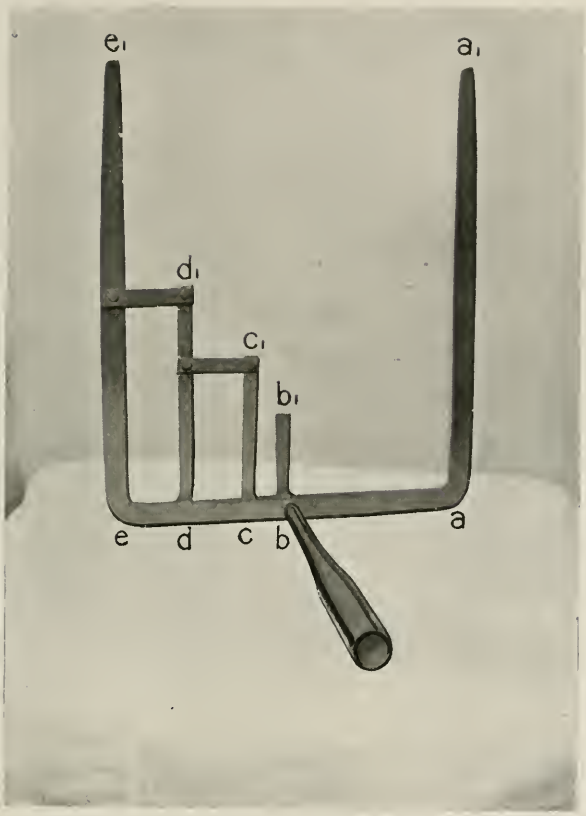
The Seafield Gauge.—No. 1.

(1)	*a b*	=	5 inches.
(2)	*a c*	=	$7\frac{1}{4}$,,
(3)	*a d*	=	10 ,,
(4)	*a e*	=	$13\frac{1}{2}$,,

The gauge is made of iron or steel, and is attached in the same way as an ordinary garden rake or hoe to a wooden shaft about 6 feet in length. It is applied to the trees at a distance of about 9 feet from the ground, and the trees are marked with white or red paint according to the following scheme :—

Tree diameter	Class	Marks
(1) Trees with a diameter less than *a b*	3-inch props	●
(2) Trees with a diameter less than *a c* but greater than *a b*	5-inch props	■ ■
(3) Trees with a diameter less than *a d* but greater than *a c*	Spars	■ ■ ■
(4) Trees with a diameter less than *a e* but greater than *a d*	Timbers	■
(5) Trees with a diameter greater than *a e*	Sleepers	▮

PLATE I.



GAUGE NO. 2.

[*To face p.* 78

Formerly the gauge was made to one size only, and while suitable for use in the measurement of woods where there was a fair proportion of sleeper trees, was not adapted for use in woods where the timber was mainly spars and props. Accordingly Mr Gilbert Brown and the writer of these notes, who have been responsible for introducing it to the notice of a large number of proprietors in the North of Scotland, have recommended the use, when woods of the latter type were being dealt with, of smaller but similar gauges of the following dimensions:—

Gauge No. 2 (*see Plate*).

(1) *a b* = $4\frac{1}{2}$ inches.
(2) *a c* = $6\frac{1}{4}$,,
(3) *a d* = $8\frac{1}{4}$,,
(4) *a e* = $10\frac{1}{4}$,,

Gauge No. 3

(which is used for a smaller class of timber than No. 2).

(1) *a b* = 4 inches.
(2) *a c* = 5 ,,
(3) *a d* = $6\frac{1}{2}$,,
(4) *a e* = $8\frac{1}{2}$,,

When using the smaller gauges, trees with a diameter less than *a b* would again be marked with one dot, trees with a diameter less than *a c* with two dots, and so on, as indicated in the scheme for classifying the larger timber with Gauge No. 1. For the purposes of advertisement, trees classified with Gauge No. 2 might appear in the particulars of the sale under the headings of the different species, as—

(1) 3-inch pit-wood No. of trees.
(2) 4-inch ,, ,,
(3) 5-inch ,, ,,
(4) 6-inch ,, and spars ,,
(5) timbers ,,

And when Gauge No. 3 is employed, as—

(1) $2\frac{1}{2}$-inch pit-wood No. of trees.
(2) 3-inch ,, ,,
(3) 4-inch ,, ,,
(4) 5-inch ,, ,,
(5) 6-inch ,, and spars ,,

in ascending scale in each case.

Another gauge might be constructed on the same lines for use in woods where there is a fair proportion of sleeper trees with a diameter exceeding 17–18 inches, and where the forester may find it desirable to separate the sleeper trees into two or three classes. In practice, however, it is not a very difficult matter to classify woods of this kind with Gauge No. 1, relying merely on an ocular inspection of the trees for the subdivision of the sleeper-sized timber.

In classifying, with the help of these gauges, timber which is to be exposed for sale, it is necessary to note that in marking any particular lot of timber, one gauge only should be used throughout the process. If there are two lots of timber to be dealt with, the one containing sleeper-sized timber and the other, perhaps on the adjoining area, chiefly timber of spar or pit-wood size, No. 1 gauge may be used for the former and No. 2 gauge for the area with the smaller timber, but the two lots should be indicated separately in the advertisement.

The reason for this will be evident when it is observed that a tree marked, say, as 5-inch pit-wood with No. 2 gauge may differ somewhat in diameter from a tree marked 5-inch pitwood with the No. 3 gauge. The principle underlying the use of the gauges is not primarily to have the trees classified according to their diameter at any particular height, but to separate the timber into four or five classes with diameters differing from each other by 2–3 inches. This is, of course, a method generally approved of in scientific works on the mensuration of timber.

When the marking of the timber has been accomplished in this manner, it will be found that the trees have been very uniformly graded, and the total contents of the stand can be found by determining the contents of the average tree in each group or class, and multiplying this by the number of trees in the group, and adding together the total contents of each of the groups or classes.

The most accurate method of determining the average tree in any particular group would be to recalliper all the stems in that group at breast-height, adding the basal areas of the individual stems (which can be readily obtained from tables showing the areas of circles which correspond to particular diameters) together in order to get the total basal area of all the trees in the group or class. The total basal area can then

be divided by the number of stems in the group, and the result will be the basal area of the average tree. A tree with the same basal area as that of the average tree determined in this fashion, and of average form and height, can then be felled, and its contents measured and multiplied by the number of trees in the group.

The forester or ground officer will usually, however, be satisfied with making a careful inspection of the trees without going to the trouble of recallipering the stems at breast-height, and will judge by the eye what he considers to be an average stem for the particular group or class. Either one average stem or a few average stems can then be felled if necessary, and measurements made to determine the cubical contents or the lineal feet, as the case may be.

6. Women's Labour in Forestry.

By Mary Sutherland, B.Sc.(For.).

In consequence of the universal shortage of labour, the employment of women in various branches of forestry work has been an innovation employed in many districts during the last twelve months. Formerly, women's labour for nursery work and planting was the rule on many estates, but in later years the practice has become much restricted, and the work is now done by the permanent staff of foresters.

Obviously, there is much of the work of the forest labourer which can only be done by men, and though, under present conditions, women are undertaking light felling and much of the work in connection with big timber felling, their employment in this is probably not sound forestry from the economic point of view. Yet there is much of the labour in the formation and tending of woodlands which economically can and should be done by women. If they were employed on all the lighter forms of estate forest work, the staff of men foresters could give more time to the heavy work necessary for the systematic tending of grown woods, and the work of the estate could thus be carried on in such a way as to include various operations, which at present are often neglected, and as they result in increased value of the woods, are financially justifiable. This would, naturally, make an increase in the wages bill, as women's labour should

be on the same basis as men's, *i.e.* equal pay for equal work—but this expenditure would be returned in the increased profits.

Where work can be done equally well by the women, it appears waste of labour to put men on to it, at the risk of having to neglect important work in woods which can only be performed by men. In view of increased afforestation, and the hoped-for improvement in the management of woodlands in this country after the war, this matter is of great economic importance.

The question then arises as to the relative value of men's versus women's labour in various forestry operations, and data should be collected systematically at the present time in all places where women are now carrying on different kinds of work in connection with forestry. It is the aim of this article to give an account of one experiment in the employment of women foresters in Scotland, in the hope that it may call forth criticism and comment from foresters who have had similar experience or encourage other estates to make similar arrangements.

In January last year a gang of women was organised to do planting and nursery work on Sir John Stirling-Maxwell's estates —at first in Renfrewshire, and later on moving north to continue work on estates in Inverness-shire when the planting season came on. The girls were in charge of a forewoman who had some previous knowledge of the work, and in each place the work was carried on under the direction of the forester.

It was found that for light work requiring careful manipulation and patience, such as the sorting out and counting of seedlings taken from the seed-beds, the women worked more rapidly and carefully than the men, and the placing of transplants in lining-out and planting operations was thoroughly and carefully done by them. In several heavy operations, results showed that women labour alone was not economic, as, although they could perform the work, the cost was increased by the longer time taken over it, whereas when working in conjunction with men the operations were better distributed and the work satisfactorily performed.

The following figures may be interesting :—

NURSERY WORK.

Sorting out, counting seedlings, and putting into bundles :

Work done by women ... 3 bundles.
,, men ... 2 ,,

Lining-out 2-year seedling larch:

2 men + 3 women averaged 4320 plants per day (8 hrs.).

In this case the trenching was done by the men, the girls placing the plants and helping in filling in, etc., and working by "breaking the line."

Planting.

Pit-planting in moderately heavy soil:

Holing and planting—1 woman did about 200 per day (7 hrs.).

Holing alone (from one test only)—1 woman did 230 per day.

This work was carried out by a different squad of girls, who were unused to manual work, and is not representative.

Pit-planting—Belgian system of peat-planting:

With circular spade—average 130 per girl per day.

Notch-planting, with Mansfield spade on rocky ground:

Douglas 2-year 1-year seedlings—alone 1 girl planted 180 per day.

This was not satisfactory, owing to the difficult ground being worked on, and the following method was adopted, viz. each man worked with a girl, cutting the notch, while the girl placed and firmed the plant.

Average for each worker—290 plants per day.

Larch 2-year 2-year seedlings:

Per couple, average	...	635 per day.
Highest	... ...	850 ,,
Average for 1 man alone...		600 ,,

The work was typical of such as would be required for afforestation on many areas in Scotland, and the girls proved that they could stand severe weather conditions without interruption to their work.

Besides this part of the work the girls carried on pruning—in nursery lines and in young plantations—*e.g.* the removal of double leaders and spreading growth liable to snow damage; thinning and weeding in young plantations by sawing down and removing weed-growth. Actual figures for the amount done are not available for comparison—in one case about four acres of a 15-year-old larch plantation were thinned and cleared by six

girls in 4½ days. This type of work appears very suitable for the woman forester, and figures for labour thus expended would be valuable.

In view of the increased demand for planting labour this season, the above results from actual experience may be useful. Since giving up this work, the writer has been able to compare results with those obtained for a gang of women working on the Liverpool Corporation Catchment Area in Wales, which agree with those obtained in Scotland in showing that, while the employment of women in heavy work, such as trenching, etc., is not profitable, in the lighter work of the nursery and plantations, given good conditions for work and reasonable hours, the labour of women will be a valuable factor in the future of British forestry.

7. The Birch in the Scottish Highlands.

By Colonel MARTIN MARTIN.

Probably the birch is one of the limited number of trees indigenous to the land of the Gael, as well as to other primitive districts such as the home of the Red Indian, for there is no trace of a rumour as to its introduction. It is the most picturesque accessory to our mountain landscapes, and has employed the brush of Millais and of every painter who has sought to portray Highland scenery, mixing as it does admirably with the grouping of the red deer or the dash of the torrent over linn and rapid. And again, it has a prominent place in song. We all remember "The Birks of Aberfeldy," and also "The Birchen Babes," referring to the history of Achnacarry.

But when it comes to appraising the commercial value of the timber to be obtained from this tree, its reputation does not stand so high, and it is very little in demand except for the manufacture of spools or bobbins, and perhaps for household furniture, for which it is said to be useful. Certainly birch bark makes excellent canoes, but we have no use for these, and the thick tough bark that serves for this purpose in America comes from a different species than the Highland variety.

All of us would regret the total disappearance of this most graceful tree, as we should that of the red deer or the eagle. Happily there is little chance of such extinction, but it is quite

another question in these difficult times whether the birch woods in many places should not give way to plantations of more valuable timber in the commercial sense. The birch is frequently to be met with in areas where no other tree is to be seen, nestled away from the wind in ravines that shelter it. In these areas good soil is uncommon and shallow in depth, and it can hardly be possible that the soil is not better than the average where the birch grows, or that it is not enriched to some extent by the humus of the dead leaves dropped perhaps for centuries. The position of these groves is of course relatively favourable owing to shelter from gales, and although the area of these ravines is not great, the site might possibly repay planting with spruce or fir, in certain circumstances.

But there are other and far larger areas covered by birch in the Highlands, besides these small isolated ravines, which certainly call for more profitable employment.

Such areas are frequent in the districts surrounding my own home and attain many square miles in extent, notably on the south shore of Loch Eishort in Skye, while similar tracts border the West Highland Railway from Mallaig to Fort William and beyond. Should it be thought advisable in future to substitute any other timber for the birch now growing on these lands, the disposal of the birch itself to the best advantage becomes a question of importance and one well worthy of investigation. And surely if some of this woodland comes to be cleared it will be found possible to make a better use of the timber than as bobbins, not to mention birch brooms or birch rods.

A proportion should be good enough to furnish pit-props which are so greatly in demand, and there remains also the use (previously referred to) for household furniture. The writer is not aware of how far furniture in the past has been constructed of birch, nor of its special qualifications for this purpose, having only the information that this is the case. It is, however, more possible to speak with some certainty as to the need which exists for this industry to be more developed in Britain at the present juncture. Very great dependence in the past has been reposed in the Austrian bent-wood furniture of all kinds, especially chairs, etc. And it would seem, from what is thought in the trade, that these articles will no longer be forthcoming after the war, and that a home-made substitute is greatly needed.

Highland villages, on the other hand, greatly need the introduction of small industries, such as are so usual in Norwegian, Swiss, and other hamlets, and there is frequently ample water-power to turn saw-mills, lathes, and any machinery that is necessary. The introduction, or rather the reinstatement, of mills in the Highlands is now being eagerly taken up in many districts to grind corn into meal in the manner formerly nearly universal, and to put the old water-mills into order for this purpose, towards which the Agricultural Board are prepared to grant loans of three-quarters of the cost, in a limited number of cases.

It appears as if a great opportunity now offered—viz. to erect mills capable of dealing at will, not only with corn, but as timber-sawing mills, and for driving lathes and other special plant, as may be desired. The corn only arrives at certain seasons, and there would presumably be ample opportunity and leisure to utilise the water-power available for several purposes in the one mill. The matter appears not only interesting and promising, but ripe for decision and action at the actual moment of writing.

Since writing the above I learn, from enquiry of a furniture maker on a large scale, that stocks of birchwood are always kept by members of his trade and used up; also that birch is quite useful for the handles of many tools.

8. Floods and Defective Drainage as Affecting Food Production.

By Alexander Ross,
Past President of the Institution of Civil Engineers.

In my address as President of the Institution of Civil Engineers, on the 2nd November 1915, I dealt with some economic questions, particularly pointing out and emphasising the national loss sustained in consequence of the large areas of land which are subject to floods, and to being waterlogged, chiefly owing to the defective state of our rivers and subsidiary streams.

At the time these statements did not seem to attract attention, but now that the question of food supply has been forced into

prominence, people have approached me on the subject, expressing a desire that some action might be taken to remedy this state of matters, and as a first step I have decided to reprint the following extracts from that part of my address dealing with "Floods and Drainage."

Now that the problem of the production of food has become so pronounced, I state with confidence that in no other way can such large areas of land be so quickly and at so small an outlay secured and rendered available for the purposes of production.

Much discussion has already taken place as to how to secure additional areas for cultivation, and I trust important authorities who are responsible for the provision of the food of the people will have this matter taken up and inquired into without delay.

I might also point out another important aspect which this problem presents, namely, that of providing useful national employment for our gallant soldier labourers on returning home after the war.

Such operations should not, of course, be undertaken unprepared or in a hurry, and a strict investigation and inquiry should first be instituted, and schemes prepared by competent authority and by engineers. Surely now is the proper time for this preliminary work; and I would suggest that County Councils be approached with a request to make a return of flooded lands in their districts.

Such an appeal as I have endeavoured to formulate should at any rate interest three Departments of the ministry—that of Agriculture, that of Food Control, and that of Re-construction, as affecting not only our immediate requirements, but our future position as well.

Extracts from Address.

"Any observant person moving about the country cannot fail to notice large areas of waterlogged land, and in many parts extensive districts subject to flooding.

"It is first of all essential to effective drainage that surplus water should have a free outward flow. All water must, sooner or later, find its way into the running brooks, streams, and rivers by which it is conducted to the ocean. It therefore follows, as a condition precedent to good drainage, that the streams and rivers should themselves be so regulated and controlled as to afford a free and uninterrupted flow.

"We cannot shut our eyes to the fact that in many cases our rivers and our tributary streams are not only unable to take the flood waters, but on the contrary their condition is frequently the cause of the damming back of water on the lands adjoining.

"We need not go far for examples. The River Thames, flowing past our doors, now and again rises in flood, and notwithstanding many improvements carried out by the Thames Conservancy above Teddington, in dredging, renewing and widening locks, weirs, and sluices, and in regulating the discharge of flood water, still, at times, it overflows its banks and floods large areas of land, streets and dwelling-houses, causing much damage to produce, crops and property.

"The Thames is by no means an exception. There are large areas of land in the valleys of numerous other rivers in England, Scotland and Ireland which in times of exceptional rainfall are deeply flooded, causing in the aggregate enormous losses to land-owners and their tenants.

"The largest agricultural areas subject to floods are on the east side of England, and are included in the valleys of the Waveney, the Bure, and the Yare, all discharging into the sea through the narrow channel of the Yare at Yarmouth, and in the valleys of the Great Ouse, the Nene, the Welland, and the Witham, flowing into the Wash through separate channels.

"In many cases measures for improvement would meet with difficulties, and the works might be costly, but in not a few instances a quick return might be expected, while in others the improved value over a period of, say, 25 or 30 years would be sufficient to redeem the capital expenditure.

"It is not, however, always the case that in the valleys of rivers with the least fall or the most sluggish flow the greatest damage occurs. As an illustration of this fact I may refer to the River Spey.

"The Spey is credited with having the most rapid flow of any river in this country. It is about 100 miles in length and has a fall of 1145 feet, or a rate on the average of nearly 12 feet to the mile. The river flows in a north-easterly direction, and takes a sinuous course through a wide and fertile valley, sheltered for the most part by high mountain ranges on each side. Needless to say, on the mountains on each side forming the gathering-area the rainfall is heavy, and is intensified at times by melting snow. Hence the river is subject to sudden and violent floods.

"Notwithstanding the advantages of an abundance of fall, this river, especially for the upper third of its length, is most destructive, so much so that of the area of the lands adjoining the first 30 miles thousands of acres are permanently soaked with backwater and rendered unfit to grow anything better than rank grass and rushes, while the greater part of this area is little better than a marsh, a striking contrast to neighbouring land where drainage is possible.

"Rivers situated like the Spey are fed from both sides by streams rushing down the mountain sides and joining the main channel at right angles to the flow, carrying with them loose stones and gravel, which form obstructive barriers across the river and sectionalise it into pools and currents, preventing an easy and uninterrupted flow.

"A good deal of laudable but isolated effort has been made, by forming embankments and executing other works, to minimise the destructive effects of the floods, but it is obvious that works in the higher parts of the stream will not benefit the lands below, and it is not to be expected that a riparian owner of the lower part of the stream would incur large expenditure which would mostly benefit the lands above. Clearly, in the case of any river it must be dealt with comprehensively as a whole, and that can only be done under legal authority backed by financial support. To rectify and correct the River Spey would not involve an onerous financial burden compared with the immense benefit which would accrue.

"I cite the case of this river as an example within my own knowledge, but although an aggravated case, it is by no means an exceptional one. It may, however, be taken to be typical of numbers of rivers flowing through the valleys of the mountainous portions of the kingdom, and it is *to such sheltered valleys* that we must look for a large addition to our *available productive lands.*

"In dealing with rivers, every case must be considered on its merits. In certain instances much harm might be done by disposing of the water stored up inland and gorging the outlet, and it must not be forgotten that the more perfect the arterial drainage of the country, the more rapid will be the discharge of the flood waters, and provision should be made accordingly.

"Again, in considering damage to lands by floods, we must differentiate between grazing lands, where an occasional flood

does little damage, and agricultural lands, over which immunity from floods must be secured."

. . . . .

"By river improvements, drainage, and reclamation from the sea and inland waters and of the fen lands, and also by the reclamation of moorland wastes, large additions can be made to the arable and the pasture lands of this country.

"No time should be lost. Why should we import our food-stuffs if by an effort we can remove the lethargy, if not the indifference, of the past, and can largely provide ourselves?

"By commencing at once we can correct many things and help ourselves to a large extent immediately, although it may take many years before we can reap the full benefit; but there seems no reason to doubt that in course of time the United Kingdom would be in a position to supply its own simple necessities: and if instead we say the United Empire, then indeed we can provide for all our wants.

"Now is the time for the authorities to set about instituting a searching inquiry into all matters bearing on economic subjects, and be prepared to commence relief works of utility of all kinds as soon as our gallant soldiers return, and in no more suitable situations can they be employed than in their own part of the country and among their own friends."

9. The Forests of New Zealand.

Mr D. E. Hutchins has been preparing for the Government of the Dominion a report on the forests of New Zealand. Some extracts from this report appear in *The Dominion* for 10th November last, and we reproduce these below.

The forests of New Zealand, Mr Hutchins observes at the outset, are, after the climate, the best natural asset possessed by the Dominion. They have escaped development solely because New Zealand has been developed by men coming from a country where there is no State forestry. "The coal-fields and gold-fields," he continues, "have been examined by engineers and geologists. If a fraction of the development that has been put into coal-mines and gold-mines had been bestowed on the forests, they would now be more valuable national assets than the coal-mines and gold-mines put together.

Thus the New Zealand coal-fields have produced up to date a total of £22,610,067 worth of coke and coal. With a proportionate attention to forestry, with no appreciable loss to other industries, nothing more, in fact, than a very little poor grazing (of which much has already gone back to scrub, gorse, and other noxious weeds), the forest industry could have produced this total value of, say, £23,000,000 in two years, if only the home-market, the larger part of the Australian, and a small portion of the two other timber markets in the Southern Hemisphere had been filled. Ordinary attention to forestry thirty years ago would have enabled New Zealand to do this in part now, and later altogether. I estimate the European and Southern Hemisphere timber markets open to New Zealand as worth now £14,000,000 yearly; and these markets are more likely to improve than fall off, because all statistics show that with civilisation and industrial progress, although wood is replaced for many uses, the net result is a greater demand for wood.

"In the kauri tree New Zealand has probably the most valuable timber tree in the world. Its timber is unsurpassed by any other in the chief timber markets of the world. It grows nearly twice as fast as European timber trees, and where it is now deficient in the forest it can be interplanted to a full stock at about the cost of grassing. My investigations have shown that it is seemingly the largest timber-yielding tree in the world, taking the recorded dimensions of the historical trees in the Tutamoe forest. It is not quite so thick or so high as some other giant trees, but it cubes larger than they do, on account of the small amount of taper in the trunk. The Tutamoe forest is not far from Waipoa forest, and can be saved for the country if demarcation is taken in hand at once. Living would be appreciably cheaper with abundant timber and firewood at people's doors. There is a firewood famine at present in New Zealand—firewood near most of the industrial centres being as dear as good sawable timber in Europe—while a timber famine is rapidly approaching. New Zealand at present is being stinted and starved in two of the prime necessaries of civilisation—timber and firewood. The present use of timber in New Zealand has become restricted to an average of only 25 cubic feet *per capita*, while the United States had a yearly consumption of 160 cubic feet timber and 96 cubic feet firewood.

Germany, with a large population on a small area, has a yearly consumption of 19 cubic feet timber and 18 cubic feet firewood, thus releasing a large surplus of coal for exportation. Other countries, excepting England, show similar figures. New Zealand, with its comparatively small population, is already importing half a million pounds' worth of timber yearly, and much coal.

"The millable forests of New Zealand contain over double the timber per acre of the great national forests of the United States of America, covering an area of over twice the total land area of New Zealand. The market value of New Zealand timber in the forest is now nearly double European prices; and the growth of the trees, if the forests were cultivated as in Europe, would probably be about double the growth of European timber trees. The five chief timbers of New Zealand—kauri, totara, rimu, white pine, and the beeches—grow decidedly faster than the five chief timber trees of Europe—the oak, beech, Scots pine, spruce, and silver fir. Thus, if we take the figures published by the late Mr Matthews in his book *Tree Culture in New Zealand*, and compare them with the standard yield-tables of European foresters, published in Sir W. Schlich's Manual, it is seen that the New Zealand timber trees grow, on an average, about twice as fast in diameter and from 25 per cent. to 50 per cent. faster in height-growth. Speaking in a general way, European timber trees are cut at about one hundred years of age, when they are about 1 foot thick. Kauri is fit to cut at one hundred years, and is then 2 feet in diameter. If the New Zealand trees were grown under the most favourable conditions, as in the cultivated forests of Europe, it seems safe to say that the growth would be twice as fast. New Zealand forests are nearly all coniferous and the most valuable in the Southern Hemisphere. According to the American official publication, *Forest Resources of the World*, New Zealand should be a great timber-exporting country.

"The results achieved in European forestry when one looks into the figures are phenomenal. They are more striking than the advances made along those lines of development that are more familiar to Englishmen, such as agriculture, mines, fisheries, roads, etc. One hundred and fifty years ago there were no Forest Departments in Europe, and most of the forests were in worse order than the present demarcatable forest of new

Zealand to-day. Money for improving the poor European forests was advanced by Government or paid for by cuttings from the better forests. The forests were worked and gradually improved by forestry methods, paying their way in the process.

"The Prussians have kept, perhaps, the best statistics. Details given in my report show that in a man's lifetime of 74 years the effective timber-yield in Prussia has been increased nine-fold, and the money-yield more than ten times! With the making of forest roads the value of timber has gone up, too. Timber which was worth from 1d. to 2d. per cubic foot in 1830 had an all-round average price, when this war broke out, of $3\frac{3}{4}$d. per cubic foot. In the most productive of European forests, the spruce forests of Saxony, timber averaged 2d. per cubic foot in 1830. When the war broke out it had risen to 6d. or $6\frac{1}{2}$d. per cubic foot. In France results have been similar. The national forests in Europe now yield handsome profits:— to the five chief German States, £6,000,000 yearly; to France (robbed of its best forests in 1870), £1,000,000 yearly; to Russia (from an area of only partly-developed and worked forests exactly ten times the size of New Zealand), $4\frac{1}{3}$ million pounds. These are net revenues paid yearly into the State coffers, and all come from forests worked conservatively, and steadily improving. In the kingdom of Prussia the State forests are the best revenue-producers after the State railways, good and moderate in fares as these are . . .

"There is no question as to the feasibility of applying ordinary forestry methods to New Zealand forests. It has been done for thirty-two years in South Africa, where the 'bush' so closely resembles that of New Zealand. The employment in European forests comparable to those of New Zealand, and allowing for shorter working hours, is at the rate of one man per 100 acres. This is the rate adopted in my report for all calculations of employment, settlement, and money returns, supposing that the New Zealand forests were developed on the lines of those of Europe. At present, with the waste places desolate and no national forestry, the average number of bread-winners on the land (agricultural and pastoral) in New Zealand is one man per 602 acres. Most of the expenditure in European forests has been in making roads. As a rule, planting is only used where natural regeneration fails. The state of Baden has forests which supply the best model in management for New Zealand

to copy. All details are given in my report; but it may be noted here that, while an average of 2s. per acre per year is spent on roads, the proportion of planting to natural regeneration is only 1 per cent.

"For reasons which have never been satisfactorily explained, it has been thought that the valuable native forest of New Zealand should be replaced by artificial plantations of exotics—a quite unusual proceeding in forestry. To do this effectively the cost would be quite prohibitive; nor is such a high expenditure justified, considering the risk which naturally attends the planting of exotic trees. This risk is five-fold, as detailed in the pages of my report. The cost of the plantations up to date is at the rate of £13 per acre, or with the inevitable interest charge, £65 per acre. The total area planted is 30,000 acres, so that the money sunk up to date in forest plantations approaches £2,000,000. These plantations can not be expected to equal improved native forests. Plantations are required in New Zealand, but for special purposes only, such as eucalypt plantations for railway sleepers in the north, and to form suburban forests near towns, for defensive purposes, for recreation, and to lower appreciably the cost of living. They are unknown in England, but common elsewhere in Europe.

"It is shown in my report that, for cultivation and development on the European plan, the ordinary New Zealand bush is worth to-day from £300 to £500 per acre; so that the present plan of destroying the most valuable forests in the Southern Hemisphere and replacing them by risky plantations of exotics means a certain net loss to the country of £365, or more, per acre—namely, £300 or more to cover the value of the native forest, and £65 for the cost of laying down forest plantations to replace the lost forest. This is why forest demarcation is so urgent, in order to stop at once this unnecessary waste.

"To put New Zealand forestry into the position of other civilised countries, the two urgent measures immediately necessary are (1) forest demarcation, (2) the formation of a technical non-political Forest Department, on the lines of the Forest Service of the United States of America."

10. Summary of the Report of the Forestry Sub-Committee of the Reconstruction Committee.

For the sake of completeness we give below the eleven main conclusions contained in this report. Three of these have been already quoted by Colonel Stirling in his article (pp. 74, 75), but for reference it is convenient to have the whole in sequence :—

"(1) The total area under woodland in the United Kingdom before the war was estimated at 3,000,000 acres, the annual yield from which is believed to have been 45,000,000 cubic feet, or about one-third of what it should have been under correct silvicultural management. These figures indicate the unsatisfactory condition of British and Irish woods as at present managed, and prove the urgency of remedial measures in the interests of national economy.

"(2) During the five years preceding the war the average annual imports of timber similar in character to that produced in the British Isles were equivalent to 550,000,000 cubic feet of standing timber. The home production was therefore less than 8 per cent. of the consumption. The imports of timbers of all kinds during the years 1915 and 1916 were respectively three-quarters and two-thirds of the normal pre-war imports, and their cost for the two years was £74,000,000 or £37,000,000 in excess of their pre-war value. These imports absorbed 7,000,000 net tons of shipping, equivalent to approximately 14,000,000 tons dead weight.

"(3) The area of land utilised for rough grazing, but capable of growing first-class coniferous timber of the same character as that imported, is not less than three and probably more than five million acres. Two million acres could be devoted to timber production without decreasing the home production of meat by more than 0·7 per cent., and if so used would ultimately afford employment to at least ten times the number of men now engaged on that area.

"(4) Dependence on imported timber has proved a serious handicap in the conduct of the war. The United Kingdom cannot run the risk of future wars without safeguarding its supplies of timber as every other Power that counts has already done.

"(5) In order to render the United Kingdom independent of imported timber for three years in an emergency, it is necessary, while making due allowance for an improved yield from existing

woods, to afforest 1,770,000 acres. Taking eighty years as the average rotation, we advise that two-thirds of the whole should be planted in the first forty years. We consider that the quota to be planted in the first ten years should, in view of the initial difficulties, be limited to 200,000 acres, of which we advise 150,000 acres should be planted by the State and 50,000 acres by public bodies and private individuals assisted by grants, or by co-operation between them and the State. The area to be planted by the State in subsequent years may be reduced in the same degree as private individuals come forward to undertake the work.

"(6) It is not proposed to plant arable land, but a limited area of arable land should be acquired with the forest sites, wherever possible, in order to provide small holdings for forest workers. Our proposals carry with them the important contingent advantage that they will cause large areas of the United Kingdom, now almost waste, to be put to their best economic use. They will also, if provision is made in time, afford the means for settling discharged soldiers on the land under healthy conditions.

"(7) Foresty demands long views, but the first-fruits are not so long delayed as many imagine. The policy of State afforestation which we recommend will begin to provide pit-wood, from the quicker-growing species on the better kinds of mountain land, from the fifteenth year onwards; by the fortieth year the plantations made in the first ten years alone will contain sufficient timber to keep our pits supplied, in emergency, for two years on the scale of present consumption.

"(8) The first essential is a Forest Authority equipped with funds and powers to survey, purchase, lease, and plant land, and generally to administer the areas acquired, with compulsory powers to be exercised, when needed, after due enquiry and the award of fair compensation. The care of forestry, now divided among several departments, should be centralised in this body.

"(9) We recommend that the Authority should be authorised to make limited grants for every acre replanted or newly afforested during the first ten years after the war by public bodies or private individuals; such plantations to be made in accordance with approved plans and conditions.

"(10) We estimate the cost for the first ten years at £3,425,000. It may be necessary to invest £15,000,000 altogether in this enterprise during the first forty years. After that time the

scheme should be self-supporting. The financial return depends on prices, wages, bank rates, etc., which are difficult to forecast. Forests are a national necessity; the country must have them, even though they yield less than the current rate of interest on the capital invested. The whole sum involved is less than half the direct loss incurred during the years 1915 and 1916 through dependence on imported timber.

"(11) The above proposals are framed in the interest of national safety, which requires that more timber should be grown in the British Isles. There remains a further question. The United Kingdom derives more than half its imported timber from virgin forests in foreign countries, which are steadily being depleted. Canada contains the only large reserves within the Empire. Unless arrangements can be made with the Dominion Government for the effectual conservation of these reserves, it is inevitable that provision should be made within the British Isles on a far larger scale than is here proposed for purposes of defence. We consider that this question should be taken up at once with the Dominion Government."

The Report is published by H.M. Stationery Office at the price of 1s., and can be obtained through a bookseller, or direct from 23 Forth Street, Edinburgh.

NOTES AND QUERIES.

The Great War.

The Society's Roll of Honour.

Sixth List.[1]

Auchterlonie, Alexander, Weekley, Kettering. A.S.C.

Blair, James Hunter, younger of Blairquhan. 3rd Seaforth Highlanders.

Brunton, James, Horsley, near Winchester. Lance-Corporal, 2/4th Hants Regiment.

Curr, James, Prestonkirk. K.O.S.B.

Dewar, Major H. R., Beaufort. Lovat Scouts.

Forbes, A. H., Bute Estate's Office, Cardiff.

Munro, George, of Kergord. Captain, R.A.M.C.

[1] For First, Second, Third, Fourth, and Fifth Lists see Vol. xxix. p. 192, Vol. xxx. pp. 47 and 129, and Vol. xxxi. pp. 66 and 168, respectively.

Forestry Importance of Myelophilus minor, Hart.[1]

A very important investigation has recently been completed by Mr Walter Ritchie, B.Sc., on "The Structure, Bionomics, and Forest Importance of *Myelophilus minor*, Hart." (*Transactions* of the Royal Society of Edinburgh, vol. lii., part 1), the work having been undertaken with the help and guidance of the Society's Hon. Entomologist, Dr R. Stewart MacDougall.

Foresters are only too well acquainted with the appearance of the common pine beetle and its destructive work, but here we have another species of the genus, hitherto regarded as rare in this country, which has now been found by the author "occurring in very large numbers over an area of 15 square miles in the Aboyne district of Aberdeenshire." This, we may assume, was the area which the investigator found most suitable for his purposes in carrying out the research, and no doubt further investigation will reveal other wide areas equally infected. In any case, it is sufficiently disquieting to know that this new forest pest in Britain occurs in very large numbers over such a wide area, as this is quite sufficient to give rise to a future epidemic. The damage done by bark beetles, which are especially destructive to pine plantations in all stages of growth, consists in their attacking and boring into the shoots of the current year, which are thus destroyed, and also in boring into the stems and tunnelling out their broad galleries in the living bast and cambial regions, which ultimately kills the tree so attacked.

On the Continent *M. minor* has been found to attack a number of species of pine; but as yet in Scotland it has only been found on the Scots pine.

A large part of the paper is devoted to a careful study of the bionomics of the two species, but what will interest the practical forester most is the means at his disposal to combat their ravages. The damage done to the young shoots by *M. minor* may be equally bad, if not worse, than that caused by its more commonly known relative *M. piniperda*. A very important difference between the two species is that *M. minor* prefers standing trees for brood purposes. It bores into and tunnels out the bark of the higher part of the stem and also of the side branches in preference to the thicker bark on the lower part of

[1] In order to avoid confusion, it may be mentioned that *Myelophilus* is an alternative generic name for *Hylurgus* or *Hylesinus* of the British catalogue and text-books.—Hon. Ed.

the stem. The author failed to find it breeding in specially selected and felled trap-trees, although *M. piniperda* was found breeding on them. He goes on to say: "If the woods be properly managed the increase of *M. minor* may be readily checked and their numbers reduced. The method of preparing trap-trees should be adopted, but these trap-trees should be standing trees, selected at intervals throughout the wood. Trees with badly-shaped crowns, unhealthy, damaged, or those suppressed by taller surrounding trees, should be selected if possible as trap-trees. If such trees as these cannot be found in the wood, certain comparatively thin-barked trees may be selected, and artificially be brought into an unhealthy condition by removing a ring of bark just above the surface of the ground. The use of trap-trees should be continuous from March to October to ensure success, so that suitable places at all times would be offered the beetles for their egg-laying. At regular intervals these traps, after examination, should be felled and the bark removed and destroyed, taking care that this is done before the larvæ have become full grown, otherwise in the thin-barked portions of stems some of the pupæ might be deep in the sapwood and not so easily reached.

The Care and Management of Hedges.

The recently issued volume of the *Transactions* of the Highland and Agricultural Society for 1917 contains, among other articles of interest and value to the agriculturist, an excellently written and illustrated contribution from Mr J. H. Milne-Home on this subject.

In these days when fencing materials of all kinds are so scarce and dear, and are likely to remain so for some time to come, it is fitting that some attention should be paid to existing hedges, in order that their utility as efficient fences should remain unimpaired, and that those which are in an unsatisfactory state should be again rendered serviceable by appropriate treatment. Mr Milne-Home's article does not set out to give information as to the formation of entirely new hedges, although abundant references are given as to where such information can be found. It, however, deals in a very clear and satisfactory manner with the care and regeneration of existing hedges. It is difficult to draw up a hard and fast comparison between the relative cost

of enclosing fields by wire fencing and by hedges, but from carefully kept records the writer shows that on an average hedges cost 1s. per acre, allowing 40 yards of hedge per acre enclosed at 3d. per yard. The actual cost will no doubt vary in different parts of the country and according to the area of the fields enclosed, but apparently 1s. per acre is a fair and good average for upkeep if the fence is in good order to start with. Otherwise double the cost may be necessary for a period of years. If wire fences predominate, the labour cost would be less, but the material required would be considerably more. This is a point of weighty importance in rural economics. The former method of fencing gives constant employment to a large number of men in rural districts, while the latter requires more artificial material and offers less opportunity for the employment of labour on the land. Though the care and management of hedges primarily concern the agriculturist, still the duty frequently devolves upon the estate forester, and no doubt this able article by Mr Milne-Home will be read with interest by the silviculturist.

Modern Ensilage Practice.

Another article in the same volume which touches upon matters of interest to the forester is one by Mr A. W. Oldershaw, on the subject named above. It may at first sight be difficult to see the connection between modern ensilage practice and forestry, but when it is explained that there are two modern types of silos, namely, the modern concrete silo and the modern stave silo, the relationship will become more apparent. A number of modern stave silos have been erected within the last few years in East Anglia, by a firm of timber merchants in Norwich, who have made their manufacture a speciality. They are 16 feet internal diameter, and 32 feet high, with a concrete foundation. The cost has varied from £100 before the war to £160 in January 1917. The chief objection to this type of silo is its possible want of durability. The oldest one in this country was erected four or five years ago, so there has not been time to form any definite conclusions as to their durability, from British experience. But in America the modern stave silo is found to last from five to twenty-five years, according to the quality of the material used in its construction, and the care and attention bestowed upon it. The chief advantage of the wooden

silo is that it can be removed, and hence it is suited for erection by the tenant farmer.

Among the materials which can be made into ensilage with success, bracken is mentioned. It is said to contain a large amount of albumen. The bracken should be cut while it is young and juicy and before the curl has gone out of the leaf. It is stated that when bracken silage is well made, stock eat it readily and thrive upon it.

Early Transplantation of Exotic Conifers as a Protection against Frost Damage.

When planting some of the exotic conifers, such as the Douglas, Sitka, *Albertiana*, and *Thuja*, there is always a danger that the leaders may get damaged by spring frosts, and various expedients have been tried to overcome this. I have noticed that plants that have been moved in the nursery the year before planting out have not been so much affected by the spring frosts as those that have been left in the nursery lines for two years. This is probably because the plants that have been moved have made more fibrous roots and not so much height-growth, while those that have not been moved have made longer but less fibrous roots, which are more likely to be damaged in transplanting, and longer leaders, which are soft and more liable to be damaged by frost. I would, therefore, recommend that all the exotics, especially the Douglas, should be transplanted in the nursery the year before being planted out, especially in places where there is a danger of spring frosts.

W. Steuart Fothringham of Murthly.

Increase in Prices of Imported Timber, 1913-1917.

The English Forestry Association have issued a leaflet on the increase in price of imported timber between 1913 and 1917. The figures, which are here given by the kind permission of the Association, cannot fail to be an effective argument for encouraging forestry and the production of home-grown timber. In this connection it is interesting to note that, though, low as was the price of home-grown timber before the war, the price has not risen in anything like proportion to that of imported timber.

PRICES OF IMPORTED TIMBER. MERCHANTS' PRICE TO CONSUMERS, IN DOCKS, LONDON.
(Reduced to Cubic Foot Basis, Sawn Square.)

	1913		1914		1915		1916		1917	
	Jan. to June	July to Dec.	Jan. to June	July to Dec.	Jan. to June	July to Dec.	Jan. to June	July to Dec.	Jan. to June	July to Dec.
3 ins. by 9 ins. 2nd Archangel Yellow (Scotch), per cub. ft.	s. d. 2 3	s. d. 2 4¼	s. d. 2 3¾	s. d. 2 6½	s. d. 2 9½	s. d. 3 0¼	s. d. 3 9	s. d. 4 4	s. d. 5 0	s. d. 6 7
3 ins. by 9 ins. 3rd do. ,,	1 10	1 10	1 9	2 1	2 4	2 11	3 5	4 0	4 7	6 1½
3 ins. by 9 ins. 4th do. ,,	1 7	1 8½	1 7¾	1 11¼	2 2	2 9½	3 3½	3 10½	4 4	5 10
3 ins. by 9 ins. 2nd Archangel White (Norway Spruce), ,,	1 9	1 9	1 9	1 10	2 4½	2 9½	3 9	3 10½	4 8	6 2
3 ins. by 9 ins. 2nd Canadian Spruce, ,,	1 7	1 7¾	1 7¾	1 8½	2 3¾	2 6½	3 6	3 10½	4 4¾	5 10½
3 ins. by 8 ins. to 2½ ins. by 7 ins. unsorted and/or Swedish Yellow (Scotch), ,,	1 5½	1 6	1 5½	1 9	2 1	2 4½	3 2	3 7½	4 3¼	5 8½
2 ins. by 4 ins. do. ,,	1 4	1 4¾	1 4	1 8½	2 0	2 3	3 0¼	3 6	3 11¼	5 2½
Commonest grade (Wrack), ¾ in. by 4 ins. up to 4 ins. by 9 ins. ,,	1 0½	1 0½	1 0½	1 4	1 7	1 10	2 4½	3 0	3 5½	4 7½
1 in. by 6 ins. unsorted and/or 2nd Yellow Floorings (Scotch), per square or 100 ft. super.	12 6	13 0	12 6	14 0	17 0	19 0	26 0	28 0	35 0	47 0
⅝ in. by 6 ins. Do. Matchings, per square or 100 ft. super.	8 6	9 0	8 6	10 6	12 0	13 0	16 0	21 0	23 6	30 0

NOTE.—The War Risk Insurance has varied from 3 to 20 per cent. The October (1917) rates average 7 per cent.

Prices of Imported Timber (*Continued*).

	1913-14	1915-16	1917
Pitch Pine Logs (*Pinus Palustris*), per cub. ft.	1/6 to 2/6	3/- to 5/-	5/- to 7/6
Oregon Pine (*Douglas Fir*) Planks, ,,	2/- to 3/-	3/6 to 5/-	5/- to 7/6
Silver Spruce, from Oregon and British Columbia (Planks), ,,	2/6 to 3/6	3/6 to 9/-	10/- to 14/-
Mahogany Logs:—			
Honduras (average), ,,	6/6	8/6	15/-
Cuba ,, ,,	6/6	8/6	12/-
African ,, ,,	5/6	7/6	10/-
Japanese Oak Logs, ,,	2/- to 3/6	4/- to 6/-	6/- to 7/-
American Sill and Wagon Oak Planks, ,,	2/6 to 3/6	4/- to 7/-	?
American Whitewood Boards and Planks (*Tulip Tree*), ,,	3/6 to 5/6	5/6 to 8/-	8/- to 9/-
Quebec Birch Planks, ,,	1/6 to 2/6	2/6 to 6/-	?

Haulage of Timber by Motor Truck.

The following figures are based on my twelve months' experience in the use of motor haulage of converted timber from the saw-mill to the railway station. I do not make any recommendation for the use of these petrol-driven vehicles, but have pleasure in submitting my figures in the hope that some of the members may find them of interest. My experience is that motor haulage is *the* method for the speedy removal of timber from alongside a good road, but it cannot compete with the tractor when it leaves the macadamised roads.

A typical week's haulage of newly-sawn timber was—

1500	...	8 ft. × 9 ins. × 5 ins. sleepers.
555	...	9 ,, × 9 ,, × 4½ ,, ,,
210	...	8 ,, × 9 ,, × 4 ,, ,,
880	...	8 ,, × 8 ,, × 4 ,, ,,

which together contained approximately 7000 cubic feet (allowance for wane). These sleepers were taken to the station—a distance of two miles, average road—in 48 loads. The week's consumption of fuel was 52 gallons of Taxibus petrol. In consigning thousands of these sleepers, I find the weights average about 50 cubic feet to the ton; the week's consignment, 7000 cubic feet, therefore, would weigh 140 tons.

From the above figures, the cost in hauling 1 ton comes out at ·185 of a gallon per mile, or 100 cubic feet of converted timber on ·370 gallon per mile. At present prices of petrol, the fuel cost of motor haulage would work out somewhat as under—

8½d. per ton per mile.
1s. 5d. per 100 cubic feet per mile.

H. Watson.

Steel Ships and need of Timber, 1913.

In these days of steel ships, it is apt to be forgotten that timber enters largely into the construction of the vessels at the various shipyards—in blocks for building on, uprights for supporting scaffolding, then in the sparring of holds, decks, furniture, and all internal fitments, amounting in some shipyards to one quarter of a million cubic feet. The average requirement is about 3·35 cubic feet of timber per gross ton of shipbuilding. The Clyde output in 1913 was 757,000 tons gross, or 2,535,950 cubic feet was used, and for the United Kingdom over 7½ million cubic feet, while the estimated total consumption of timber in the Clyde district for all purposes was over 14¼ million cubic feet. Taking the 2½ million cubic feet for shipbuilding alone, and allowing fifty years on the average for rotation of cutting, it would require 2 million acres to grow this timber, or for the whole Clyde area requirements 11½ million acres.

Before the war Scotland had 879,000 acres of woodlands, or 4½ per cent. of the total land area. The 1906 Commission recommended 6,000,000, or 31½ per cent., to be planted with trees. From the above it is evident that even if 2 million acres were planted and matured it would only supply the shipbuilding industry of one district, viz. the Clyde. With such enormous requirements, in the nation's interest all that is possible should be done to meet at least part of this demand.

At present manual instruction is given in 1200 schools; horticulture is taught in 571 schools to some 10,000 pupils. It appears that for the hilly and outlying districts of Inverness, Perth, Argyll, etc., etc., in, say, a total of 500 or 600 schools, tree planting and education in forestry would be most suitable and useful, while making at same time an occupation for the children as they grow older. Ten times more foresters than shepherds are required to a thousand acres.

In Austria the tree nurseries are at the foot of the mountains where the trees are to be planted, and so it should be in this country. Denmark, after the disastrous German war of 1864, laid the foundation of new and prosperous conditions in her country districts by "Reafforesting the heather lands of Jutland and draining the bogs and irrigating the upland heaths," chiefly through the educational departments. The same spirit and enthusiasm is possible in this country, and should be stimulated by co-operation with the State, colleges, and education departments, and the arboricultural societies, and with all interested in the needs of the country and the rural population.

ANDREW HAMILTON.

THE FORESTRY INDUSTRY OF JAPAN.

The Japanese Empire, being a mountainous country, is rich in forests, which, since the islands extend over almost 30 degrees of latitude from north to south, contain a great variety of trees, comprising not only trees of temperate climes, but those of a subtropical climate in Taiwan and subarctic climate in Karafuto. In Japan proper alone there are some thirty kinds of good timber trees, and over two hundred varieties if we include all others which may be called subsidiary timber trees.

(*a*) In Japan proper the area under forest amounts to 47,264,000 acres, being about one-half of the entire area of the country. If to this be added the 5,447,000 acres of wild lands (*gen-ya*), which will hereafter be afforested, the total area of forests and wild lands will form 65 per cent. of the entire area. Of the total forest lands, 9 per cent. belong to the Imperial household, 38 per cent. to the State, 17 per cent. to public communities, 35 per cent. to private owners, 1 per cent. to temples. Classified according to the objects for which the forests are maintained, 5·4 per cent. belong to the class called the Hoanrin, or "safeguarding forests," *i.e.* forests maintained not mainly for profit, but for the protection of the neighbourhood against floods, hurricanes, etc., while 94·6 per cent. are utilisation forests, that is, maintained for timber and other forestry products.

The Japanese authorities have always taken an interest in the protection and preservation of forests and woodlands. As early as the tenth century, we read of the Emperor Ojin first

establishing a *yama-mori-be*—an office for the protection of forests. In 1880, edicts were issued for the afforestation of wild lands, and in 1886 a modern system of forest administration was introduced, which was further completed by the promulgation, in 1897, of the present forestry law.

(*b*) *Afforestation.*—In 1912, 362,000 acres of wild lands were planted with seedlings, numbering altogether 544,133,000, while the seeds sown amounted to 160 bushels, the expense incurred being 4,300,000 yen. *Nursery beds.*—The forestry bureau of the Government maintains, at different places throughout the country, nursery beds covering altogether an area of 2160 acres, in which in 1912 were sown 2905 bushels of seeds, from which were obtained 337,434 seedling trees.

Subsidiary products of the forests were as follows:—

	Yen.[1]
Spars and other smaller timber	47,990,000
Charcoal	21,792,000
Planks	22,039,000
Seedlings	4,744,000
Wood for clogs	2,940,000
Railway sleepers	1,773,000
Material for making boxes	1,609,000
Mushrooms	1,563,000
Sen-no-ki	1,321,000
Cryptomeria bark	1,098,000
Stones excavated from forest lands	5,810,000
Other miscellaneous products	9,810,000
Total	122,489,000

The above facts are extracted from the guide-book issued by the Imperial Japanese Government Railway.

[1] A yen is equivalent to about 2s.

Agricultural Forestry.

The importance of shelter-belts on upland farms is recognised, but not to the extent it ought to be. Here and there in various parts of the country are to be seen examples of what provident landowners have accomplished by the skilful planting of trees.

One of the best of these examples is to be found in County

Waterford. On a south-eastern spur of the Knockmealdown mountains a colony of monks was established some eighty years ago. Their holding, which was gifted to them by the proprietor, was a bleak hillside running up to 900 feet elevation, and growing only *Molinia* and heather. The few farms that existed were poor, and their inhabitants equally so.

The monks early recognised the value of shelter, and divided their land into fields of about 30 acres. These they surrounded with 12 to 15 yards wide shelter-belts. One on the extreme windward side of the holding was made much wider. The trees are now from 30 to 55 feet in height, and provide excellent shelter. The effect of this has been striking. The hills around have still the same miserable growth of heather and coarse grass. The farms are still mediocre. But the monks holding has improved, and the beautiful green of its grass shines out as an emerald in the wilderness of brown and grey.

Much of the improvement must be attributed to the good farming of the monks, but the monks themselves attribute no small share to the shelter of the trees. They can now keep large stocks and get good crops even although the soil is naturally extremely harsh. J. M. M.

British Columbia Spruce for Aeroplanes.

The Canadian *Forestry Journal* for November 1917 states that a special staff of technical foresters has been called into the service of the Imperial Munition Board, in connection with the extensive utilisation of British Columbia spruce for the manufacture of aeroplanes. Extensive tracts of spruce in this province are exactly adapted to fulfil the required conditions for aeronautical purposes. A. W. B.

Small-Holdings and Afforestation.

At the third annual conference of delegates of the Scottish Small-holders' Organisation (Limited), which was held in Aberdeen recently, an address was delivered by Colonel Fothringham on "Small-Holdings and Afforestation," in which he pointed out that afforestation was largely mixed up with the question of small-holdings, to the extent that the forests required labour, and the small-holder in many cases required something

to work at. It was universally admitted that small-holdings must have some other industry connected with them in order to make them a success. Small-holdings and afforestation, therefore, made a very useful combination. What he would suggest was that they should have a considerable section of land in the neighbourhood of each township of small-holdings properly planned for afforestation and carried out with a view to continuity, and the small-holders or crofters employed in carrying out the work. He urged that the Small-holders' Organisation should press upon the Government the necessity, first of all, of supplying some other industry to help small-holdings, and forestry in particular as the one most suitable for a great part of Scotland. The war had shown that we could not live entirely on imported articles, and they should endeavour to induce the Government to create a Forestry Department, with responsible men at the head of it, to carry out a proper national policy of afforestation.

Ferro-Concrete Railway Sleepers.

In *Chambers' Journal* for October 1917, an interesting reference is made to the use of ferro-concrete railway sleepers. It is stated that the uses of concrete reinforced with steel bars embedded therein, and known as ferro-concrete, appear to be well-nigh inexhaustible—one of the latest being for railway sleepers. These, though externally the same size as wood sleepers, are made hollow. Their sides are 1½ inch thick, except where the rails rest on them, at which points the thickness is increased to 2 inches, and added strength and resiliency are given by oak filling pieces. Each sleeper contains 32 lbs. of steel rods, and weighs about 3 cwts. Tests are being made on these sleepers at Riverside, California, where they are laid down along a stretch of railway.

"Will Russia's Forests pay her War Debts?"

A striking article in the Canadian *Forestry Journal*, by A. J. Slack, Director, Russian Information Bureau, New York, on the question, "Will Russia's forests pay her war debts?" brings out, among other interesting facts, that Russia can take, and is going to take, the leading place in the world's timber market.

A tabular statement is given which shows that Russia possesses 1,125,000,000 acres of timber-land, as against the 132,852,000 acres of the various European countries. For a few years previous to the war the exports from Russia to Germany rose from 48·8 per cent. to 50 per cent. of the total timber imported by the latter, while the exports from Austria-Hungary diminished, and became only half of the amount Germany imported from Russia.

The report of the Russian Consul in London, which was published a year ago, shows that the imports of timber into England from Russia were increasing much faster than those from Scandinavia or the United States, and that England was receiving more timber from Russia than Germany, but even at her best Russia was far behind other timber-exporting countries in proportion to her acreage of timber-land. Russia has the material which, if properly developed, would yield the bulk of the timber necessary for other European countries. Through the development of her timber industries, Russia can find a practical solution for future financial problems by establishing a foreign trade balance which will assist in the payment of the national debt.

A. W. B.

REVIEWS AND NOTICES OF BOOKS.

Trees and Shrubs Hardy in the British Isles. By W. J. Bean, Assistant Curator, Royal Botanic Gardens, Kew. Two volumes. Illustrated. London: John Murray, 1914.

Such has been the enterprise and diligence of recent collectors —so rich and so varied their spoil—that in no similar space of time has such a number of new species of flowering plants been introduced to Great Britain as during the last five-and-twenty years. The profusion is bewildering, nor is there any symptom of the supply approaching exhaustion. It has outstripped the industry of the most up-to-date writers on horticulture. It is little more than three years since Mr W. J. Bean published his *Trees and Shrubs Hardy in the British Isles*—by far the most complete and exhaustive treatise on the subject that has come from the press since John Loudon's day, fulfilling for ornamental planting what Elwes and Henry have done for forestry in their

Trees of Great Britain and Ireland. But in those three years many new species have been brought into cultivation, while some others that were already in our nurseries in 1914 have revealed their quality in flower or fruit, and shown their adaptability, or otherwise, for a British environment. We entertain a confident hope that Mr Bean will meet the occasion by issuing a third or supplementary volume.

Let it be understood, then, that this is a book for the horticulturist and landscape gardener, not for the economic forester. The plan thereof is admirably simple. In the first hundred pages, the author supplies instruction, drawn from his own rich experience, in nursery work and methods, in propagation, planting and pruning, and a general survey of the arrangement and management of a collection of trees and shrubs. A fair example may be taken from his precepts on pruning.

"Of all the arts that go to make up horticulture, pruning is the one most frequently misapplied. Its proper practice necessitates an intimate acquaintance with the habit and nature of the subject operated on. For instance, a collection of flowering shrubs, *in so far as they need pruning at all* [the italics are ours], cannot be pruned properly unless the workman knows the time of flowering of each one. Again, the aim in pruning a large growing tree is to make it as perfect a specimen of its kind as possible; contrary to the ideas of many, it is not intended to bring it to some arbitrary, more or less formal, outline. Therefore a knowledge of size and habit is essential. Unless the operator possesses such knowledge, the plants are best left alone, for bad pruning and pruning without a definite aim are worse than none."

Regarding flowering shrubs, Mr Bean lays stress upon the mischief wrought by the too common neglect of treating alike those that flower on the previous season's growth, such as cherries, barberries, wild roses, and practically all early flowering deciduous shrubs, and the far smaller number that flower on the current season's growth, such as ceanothus, hydrangea, the summer-flowering spiræas, etc. "Briefly stated," he adds, "the rule which indicates the time to prune all flowering trees and shrubs is this: *Prune at such a season as will allow of the fullest possible period of growth before the next flowering season comes round.*" It is safe to say that even the most experienced

gardener, forester, or amateur cannot peruse the introductory chapters of Mr Bean's work without advantage. It should be borne in mind, however, that the author's observations have been conducted mainly at Kew, where a dry soil, summer heat and winter cold, provide conditions very different to those prevailing in many other parts of the realm, especially the western seaboard of Great Britain and the greater part of Ireland. No one is better aware of this than Mr Bean himself, who has visited and critically inspected gardens and parks in all districts.

"Some explanation," says he, "of the term 'hardy' as used in the following pages is perhaps needed. There is a great variety of climate in the British Isles, and the word 'hardy' has a very different significance, say, in eastern Northumberland to what it has at Falmouth or Cork. Although we are apt, almost instinctively, to regard the softness of climate as progressing from north to south, it is, in Great Britain, rather from east to west. Thus, plants can be grown on the west coast of Scotland as far to the north as Ross-shire, such as *Desfontainea*, *Tricuspidaria*, and Himalayan rhododendrons, which are absolutely hopeless at Kew."

To this I have to add but two observations: first, that there are some puzzling exceptions to the general rule that our western climate is milder than the eastern. On the shores of the Moray Firth, for instance, certain plants flourish luxuriantly which it would be vain to put in the open in Norfolk. Secondly, Mr Bean hardly lays enough stress on the deadly effect of wind upon choice trees and shrubs. Many things, especially Asiatic rhododendrons, will endure very severe winter cold without injury, but succumb, or at least forfeit all grace of growth, unless sheltered from withering winds.

The bulk of Mr Bean's two fat volumes, containing some 1400 closely printed pages, consists of a descriptive list of genera and species, conveniently arranged in alphabetical order, with a botanical description of each species, its origin, relative merit and cultural requirements. And whereas ninety per cent. of the hardy exotics described have not received distinctive names, and their scientific appellations in a dead language are subject to frequent change at the decree of the autocrats of Kew, Mr Bean has a most satisfying index, containing not only the English and authorised Latin names

of the plants described, but also those synonyms which we had become accustomed to use before they were superseded. For instance, we had all come to know the hardy palm as *Chamærops excelsa*, and might not recognise it under its new title of *Trachycarpus*, so both names are given. And this reminds me that I have written so far without performing what some critics seem to regard as their chief function, viz. picking holes. It is peculiarly difficult to find any to pick in Mr Bean's work, but this index gives me a chance. The Californian laurel is given in the text under the name *Umbellularia Californica*. Nuttall, but that name does not appear in the index, where one must seek this charming, fragrant tree under the older and more familiar title of *Oreodaphne Californica*, Nees.

No notice of these volumes would be just that did not bestow a meed of praise on Miss E. Goldring's drawings from Mr E. J. Wallis's photographs. They are both artistic and faithful, which is more than can be said of all illustrations of horticultural works, and assist satisfactorily in identifying species.

All our thoughts are now absorbed in the din of battle and the crash of powers: little attention can be given to merely ornamental work. Still, we should keep what we have got; Mr Bean's work will enable us to do so, and will endure till happier times return, and British parks and gardens resume their high place in the national assets. No surer guide than he can be had to the cultivation of the wealth of foreign flora that has been, is being, and no doubt will continue to be lavished upon us. HERBERT MAXWELL.

A Discussion of Australian Forestry. By D. E. HUTCHINS. Edited by C. E. LANE-POOLE, Conservator of Forests, West Australia. Published by the Minister controlling Forestry in Western Australia. 416 + xx pp., ten Maps and Illustrations.

Mr Hutchins has had a unique experience in sub-tropical forestry, and consequently his discussion on Australian forestry presents the mind of an expert whose knowledge of Colonial forestry is unsurpassed. The report is the outcome of a request made by the Government of West Australia to Mr Hutchins that he would visit the forests of Australia and criticise what

had been done, and advise what should be done, to improve the forestry of that continent.

The author has certainly obeyed his instructions, and the work is of a much more comprehensive and thorough nature than the title suggests. His criticism is principally concerned with the mismanagement of the Australian forests in the past. We are told that enormous areas representing untold wealth have been burnt and slashed as though the primary object was to wipe them out with the least possible delay, and that past Governments have themselves actually destroyed Jarrah belts, carrying timber worth £50 per acre, to sell the land to settlers at from 20s. to 30s. per acre.

The chief troubles appear to be fire (accidental and deliberate), a desire to form "settlements" (which latter, in many cases, are unremunerative to the settler through lack of subsidiary occupation in his slack seasons), and popular and political ignorance of forestry, with the result that the forests are unprotected, unregenerated, and even non-demarcated.

The advice given is explicit, and broadly set out and weighed, and compared with the results obtained in other countries. The main headings are—

1. Demarcate the forests definitely and finally.
2. Protect them (with a staff of 1600 foresters, at a *profit* of £12,000,000 per annum).
3. Appoint a free and separate Forestry Department, with full and perpetual power.
4. To attain these ends it is necessary to immediately establish schools of forestry to train the necessary men, and by propaganda to educate the people generally and awaken the nation to the fact that forestry is of vital national importance.

The author gives figures to prove that even if Australia *to-day* thoroughly organises her forests, she will have to pay, during the next thirty years (as a penalty for the neglect during the past one hundred years), a sum that will accumulate at 4 per cent. during that period to no less than £588,000,000; of this, £335,000,000 will be spent on imported timber based on a future import of £6,000,000 per annum.

This publication should be in the hands of every Australian, and in the hands of every Briton, for it is easy for us to see

the troubles of others, whereas the cases are curiously parallel, and if a *post*-war import of £6,000,000 is to cost the Australians £335,000,000 (in a country that can grow mature timber in thirty years), what is it going to cost us with a *pre*-war import of £43,000,000?

In several passages the author compares the wasted forests of Australia to the cleared and barren areas in Britain, and in each case puts forestry as employing ten times more men than sheep farming.

The following extracts are worth quoting for us to read and thereby learn:—"Rural depopulation is admittedly the great social problem in Australia." "Rural depopulation is bad in France, in some of the provinces, but it is eating the heart out of modern Britain." "On the Continent of Europe there is no pauperism (in the British sense), and there are no workhouses. In Britain there is no State forestry (in the Continental sense), and £43,000,000 going out of the country for imported timber, while nearly one-third of the area of the British Isles is waste land." "It is not realised by many in Britain, and by fewer still in Australia, that State forestry affords a considerable remedy for rural depopulation." "Belgium has accomplished what Britain has been talking about for the last thirty years. . . . It now has a Forest Department of 750 men, and provides winter employment for 32,000 men, and it is getting a fair interest on its forest expenditure." J. L.-P.

Farm Forestry. By JOHN ARDEN FERGUSON, A.M., M.F., Professor of Forestry at the Pennsylvania State College. New York: John Willey & Sons. London: Chapman and Hall. 1916.

This book is written primarily for the American farmer. The system of farming, and especially the position of the farms, often remote from forest regions, so that supplies of agricultural timber and firewood cannot be easily obtained, have made it necessary that each farm should have its own small area of forest, called the wood-lot, which is a tract of wooded land maintained to furnish fuel, posts, structural timber, and other wood products for use on the farm.

The wood-lot is usually situated on some part of the farm where soil and surface are not suitable for agricultural purposes;

in fact it is often a remnant of the original virgin forest which has not been cleared off for this reason. In other cases, wood-lots have originated from abandoned land which was once tilled. In the central parts of the country where, owing to competition with rank herbage, trees do not naturally reproduce themselves, the wood-lot is formed artificially by sowing and planting.

Farm forestry is simply a special branch of general forestry, and aims at bringing about the best conditions for the growth of trees suitable for the objects in view. If all land on the farm were fertile and suitable for farm crops, there would be no room for farm forestry, but there are only too frequently areas of land too poor to grow food crops, and such land is utilised to grow a crop of forest trees, which is the only profitable use to which it can be put. Farming and forestry thus go hand in hand in America.

It will surprise many readers in this country to learn that the area of wood-lots and idle land owned by farmers in America is estimated at 200,000,000 acres, an area larger than all the national and State forests. Idle land on the farm, if utilised in the proper way to produce tree crops, can contribute materially to national wealth and prosperity. The productive capacity of the 200,000,000 acres of farm wood-lots is enormous. They yield, on the average, even if only fairly well-stocked with trees, about 3000 board feet to the acre, and if under proper forest management the annual yield in timber would more than equal the cut of the entire country, which is about 40 billion board feet. It is on account of the great value of the wood-lot to the nation and to the individual that the subject of farm forestry is of importance.

A good-sized wood-lot will furnish work for both men and horses in winter, when it is often a problem to know how to employ them profitably. The two industries make a good combination, each providing profitable work in its own season, and it is easier to secure, keep, and train good labour when there is work all the year round.

In America, the value and necessary nature of wind-breaks and shelter-belts is well understood and appreciated, and the wood-lot often takes the form of these shelters for growing agricultural crops and for stock. Nor is the value of the wood-lot as a protection of the water supply and a preventive of soil erosion undervalued or ignored.

The book is well written, and contains all the information necessary for the successful cultivation of tree crops in the farm wood-lot. Many excellent photographs illustrate the text, and these are well chosen as a guide to the cultivator in showing what to aim at and what to avoid. A. W. B.

OBITUARY.

The Late Mr Scott, Forester, Darnaway Castle.

Mr Daniel Scott was born on 28th January 1846, near Blairgowrie, on the farm of Rochallie, of which his father was tenant. He received his training at Scone, Perthshire; Culzean Castle, Ayrshire; Powercourt, Co. Wicklow, Ireland; and Pennyton Castle, North Wales; entering the services of the Earl of Moray in 1871 as manager of the extensive forest areas on the Darnaway estates, he laboured there for forty-six years, enjoying the confidence of no less than five Earls of Moray.

During Mr Scott's long and capable management of the Darnaway forests, he did much to improve and extend them. He realised the importance of managing plantations on systematic lines, and with that end in view had formed a working-plan of the Darnaway forests and an estate museum, being one of the first experienced foresters to do so in this country. Mr Scott was an enthusiastic forester. He possessed great practical and scientific knowledge of his profession, being much interested in the training of young foresters, and always ready to impart his knowledge to others. For many years he was consulted by proprietors of other estates, where his unique and extensive experience and opinion were much valued. Mr Scott was a member of the Royal Scottish Arboricultural Society for fifty years, acted on its Council for some years, and was successful at its exhibitions. The Society has lost one of its best and most enlightened foresters, and by his death the profession has lost one of its ablest and most progressive votaries. Mr Scott is survived by a widow, two sons, and four daughters. His eldest son holds an important appointment with Messrs Kennedy & Sons, Liverpool and Glasgow. The second son is a civil engineer, holding a responsible position on the Canadian Northern Railway. John W. M'Hattie.

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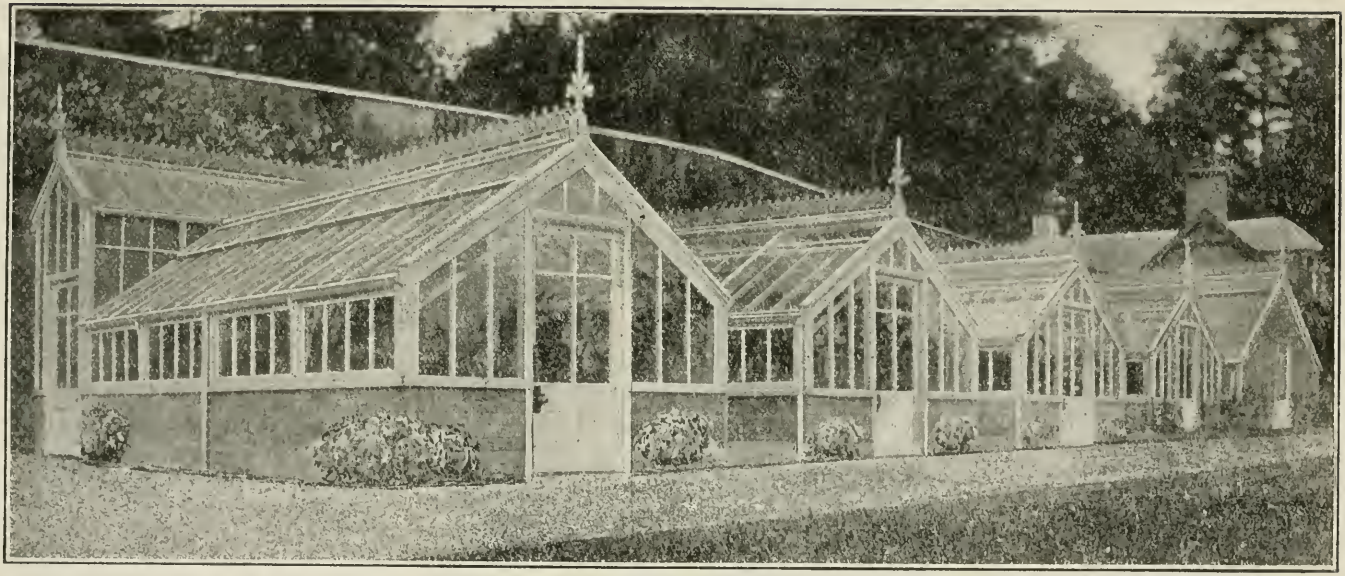

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**

Royal Scottish Arboricultural Society

FORM OF PROPOSAL FOR MEMBERSHIP.

To be signed by the Candidate, his Proposer and Seconder, and returned to ROBERT GALLOWAY, S.S.C., *SECRETARY*, Royal Scottish Arboricultural Society, 19 Castle Street, Edinburgh.

Candidate's

Full Name, ...

Designation, Degrees, etc., ...

Address, ...

Life, or Ordinary Member, ...

Signature, ...

Proposer's

Signature, ...

Address, ...

Seconder's

Signature, ...

Address, ...

[CONDITIONS OF MEMBERSHIP, see Over.

CONDITIONS OF MEMBERSHIP (excerpted from the Laws).

III. Any person interested in Forestry, and desirous of promoting the objects of the Society, is eligible for election as an *Ordinary* Member in one of the following Classes:—

1. Proprietors the valuation of whose land *exceeds* £500 per annum, and **others**, subscribing annually . . One Guinea.
2. Proprietors the valuation of whose land *does not exceed* £500 per annum, Factors, Nurserymen, Timber Merchants, and **others**, subscribing annually . . Half-a-Guinea.
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and **others**, subscribing annually . . . Six Shillings.
4. Assistant-Foresters, Assistant-Gardeners, and **others**, subscribing annually . . . . . Four Shillings.

IV. **Subscriptions are due on the 1st of January in each year, and shall be payable in advance. A new Member's Subscription is due on the day of election unless otherwise provided, and he shall not be enrolled until he has paid his first Subscription.**

V. Members in arrear shall not receive the *Transactions*, and shall not be entitled to vote at any of the meetings of the Society. Any Member whose Annual Subscription remains unpaid for two years shall cease to be a Member of the Society, and no such Member shall be eligible for re-election till his arrears have been paid up.

VI. Any eligible person may become a *Life* Member of the Society, on payment, according to class, of the following sums:—

1. Large Proprietors of land, and **others**, . . . £10 10 0
2. Small Proprietors, Factors, Nurserymen, Timber Merchants, and **others**, ... 5 5 0
3. Foresters, Gardeners, Land-Stewards, Tenant Farmers, and **others**, ... 3 3 0

VII. Any *Ordinary* Member of Classes 1, 2, and 3, who has paid *Five* Annual Subscriptions, may become a *Life* Member on payment of *Two-thirds* of the sum payable by a *new* Life Member.

XII. Every Proposal for Membership shall be made in writing, and shall be signed by two Members of the Society as Proposer and Seconder, and delivered to the Secretary to be laid before the Council, which shall accept or otherwise deal with each Proposal as it may deem best in the interest of the Society. The Proposer and Seconder shall be responsible for payment of the new Member's first Subscription. The Council shall have power to decide the Class under which any Candidate for Membership shall be placed.

TRANSACTIONS

OF THE

ROYAL SCOTTISH ARBORICULTURAL SOCIETY.

II. The Society's Annual Meeting: Discussion on the Report of the Forestry Sub-Committee, at the Meeting held on 20th February last.

Sir Andrew Agnew, in opening a discussion on the Report of the Forestry Sub-Committee of the Reconstruction Committee, said :—"I have been asked to open this discussion on national afforestation, and I do so with very great pleasure, because we have at last got something definite to discuss. The Report of the Sub-Committee of the Reconstruction Committee is a very valuable and important document. It is very valuable because it makes out such a clear and convincing case for afforestation, and it is important because it seems to bring us a good deal nearer to the goal at which our Society has been aiming for so long. We have had inquiries before by Royal Commissions and Departmental Committees, and they all recommended that something should be done, but this is the first time that a body of competent men have been requested by the Government to prepare a definite and practical scheme. I hope we may assume that, having asked them to do this, they are prepared to adopt the scheme which the Committee propose, if not in its entirety at any rate in its main features. If this is done we shall at last have seen a long-standing reproach in a fair way to being removed.

"I think it is gratifying to us here to note how closely the views of the Committee correspond with those of our own Society. When the Committee were considering their report, they asked us to send a statement of our views with regard to national afforestation. We sent those views in a Memorandum which was prepared by the Council, and was subsequently endorsed by the General Meeting of this Society, and it is

very satisfactory to see how closely the chief recommendations of the Committee correspond with those at which we had arrived quite independently. For instance, we held that 2,000,000 acres should be the minimum area which the Government should aim at afforesting, and the Committee have arrived at very nearly the same figure. What they actually propose is 1,770,000 acres. We suggested that the period within which the work ought to be completed should be eighty years. The Committee have adopted precisely the same figure, only they suggest that the greater part of the work should be done in the first forty years, so that this country might be prepared all the sooner to face another such crisis as we are going through at the present time. We thought that as landowners should be able to plant very much more cheaply than the State could do, that it would be an economy on the part of the State to seek their co-operation, and we therefore suggested that they should offer grants to enable landowners to plant much more largely than they would otherwise do, and also to compensate them in some measure for sinking large sums for which most of them would receive no return in their lifetime. This also appears among the Committee's recommendations. Again, the Committee agreed with us as to the importance of providing small-holdings in the immediate neighbourhood of the areas that were afforested, which, of course, is a policy that would be of great mutual advantage to both industries. And finally, the Committee are just as emphatic as we were as to the necessity for creating a new forest authority, and that it should be a Central Authority for the United Kingdom with executive branches in England, Scotland, and Ireland. I think all this is very satisfactory, not only because it would carry out our own views in the matter, but because it shows that all those who have studied the question have arrived at the same conclusion, and that if once the policy of afforestation is sanctioned, there should be little difference of opinion as to the best methods for carrying it out. I do not propose to say anything more as to the recommendations of the Committee because they are going to be dealt with by other speakers, and I wish to confine my remarks to two or three points of special interest arising out of the report.

"In the first place, the Committee have based their recommendation of national afforestation upon the ground of national

security. That is undoubtedly the strongest ground upon which to base it. It has perhaps been too much the practice in the past to dwell upon the profits which might be made, upon the pecuniary gains to the country from its State forests. That was a very natural argument to use when you were out to persuade an apathetic Government and a reluctant Treasury, but it never was the best argument, and it never was the argument upon which our Society laid much stress. No doubt, we all of us believed that under proper management the State forests could be made to pay their way, and more than pay their way, in this country as they have done on the Continent, and no doubt we have said so, but the argument upon which we have chiefly relied was the growing difficulty and expense of obtaining foreign supplies of wood, the certainty of an impending timber famine in the near future, and the importance therefore of providing in time against any such contingency. That is still as strong an argument as ever, and it is one which ought always to be kept in view, but the war has provided us with a still stronger argument. Large as is the demand for wood in time of peace it is still larger in time of war, while the facilities for importing it are very much reduced. In these circumstances the want of an adequate reserve of timber supplies in the country is a very great weakness to the country, and it ought to be one of the first objects of our Government to endeavour to build up a reserve of this kind.

"We know now that the first thing that happens when war breaks out is that the Government commandeer half the shipping in the country for military purposes, leaving only the remaining half for all other requirements. One of these requirements is wood. But wood is a very bulky article, and if it has to be imported it consumes a very large amount of tonnage. If, as the Committee suggests, we can grow in this country a sufficient amount of timber to enable us to hold our own for three years without importing any more wood, it would set free all this great amount of tonnage for other urgent purposes. Food and wood are two necessaries of life. The country that is self-supporting in both these commodities is in a very strong position in time of war. We can never hope to be entirely self-supporting in this country. Do what we will we can never grow a sufficient amount of food to render us entirely independent of foreign supplies, but we can grow enough wood to enable

us to hold out for several years without importation, and if we did this we could set free 5,000,000 tons of shipping which could be utilised in bringing us the food that we need and rendering us safe from any fear of being starved out, as the Germans are trying to do to-day.

"In this connection there is another point which is worthy of consideration. The Committee have shown in a very clear and unmistakable way, the loss the country has suffered through neglect of forestry in the past. Of course, we all knew in a general way, that we had to pay very heavily for our neglect, but the Committee have been able to give us some actual figures. The figures are both very striking and indisputable, and they ought to wake up those who have any responsibility in these matters.

"During the first two years of the war we imported a great deal of wood, though not to the same extent as during the years before the war—something like 30 per cent. less—but though the amount imported was 30 per cent. less the price that we had to pay for it was £37,000,000 more. When the Committee were considering their report the figures for the third year of the war could not have been available, but if we take them at the same rate the loss in three years would amount to £55,000,000. This £55,000,000 is the extra amount that we have had to pay for foreign wood and the direct result of the deficiency of timber in this country. And what an unnecessary waste of money this has been is shown by the fact that the total cost of the scheme of afforestation proposed by the Committee is only £15,000,000; that is to say, the price that we have had to pay for our neglect in the past is four times, or very nearly four times, what it would have cost us if we had been wise and made provision in time.

"There is one other point arising out of the report that I should like to mention, because I think it is one very desirable for the public to realise, and it is this, that national afforestation would be a clear net gain to the country. It would establish a new industry without disturbing any old one. The only industry it would affect in any way is agriculture, and the extent to which it would affect agriculture is so small that it would never be felt. The forester is content with soil which is practically valueless to any one else. Give him an area of rough grazing ground and he will make it worth ten times what

it would be worth to the farmer. The Committee assure us that 2,000,000 acres of that class of land could be devoted to wood without diminishing the production of meat in the country by as much as 1 per cent.—the exact amount is $\frac{7}{10}$ths of 1 per cent. —and even that trivial loss would only be gradual. It would only be reached in eighty years, so that it may be looked upon as quite imperceptible; and against that very trifling loss in meat production what has forestry to set in the balance? In the first place, we hope it will produce annually 100,000,000 cubic feet of well-grown timber, and in the next place it will provide healthy employment for ten times the number of persons employed on the same area at the present time. Either of those results would be a great boon: together they would constitute an enormous advantage to the country. Indeed, after studying this report of the Reconstruction Committee, I feel more convinced than ever that there is no development of our natural resources which could equal in value the result which may be obtained by the scientific development of forestry.

"I will conclude by moving the following resolution:—

> 'That this Meeting of the Royal Scottish Arboricultural Society welcomes the publication of the Report of the Forestry Sub-Committee of the Reconstruction Committee, and urges the Government to adopt the scheme of afforestation recommended in the Report, and to bring it into operation without delay.'"

Sir Kenneth Mackenzie, Bart., who spoke on the recommendations in the report, said:—"The recommendations appear on pages 4 and 5 of the report. The first four are mainly statements of fact. They are very nicely put indeed, but if anybody thinks them over, I think they form about the most damning indictment you could find of the policy adopted by every Government in Great Britain since the days of Queen Anne. They simply mean that no Government has done anything to this very necessary subject. We may pass from these four to the next three which are really those which outline the schemes supported by the Committee. After that they devote two paragraphs to the authorities they propose and then they go to the cost.

"Now one point about this report is that you have got a Committee composed of fourteen members who all sign it.

In my experience of committees it is very unusual to find fourteen people who are unanimous upon a subject. I think it strengthens the report very much. There are just two reservations, one by Mr Bromley, with whom I happen to be acquainted. I do not think he is a practical forester, and probably one of the reasons of his reservation was that he thought it would be more economical to strengthen the existing Boards of Agriculture than to set up a new Central Authority as suggested by the Committee. That was his view. The other view is very ably stated under the signature of Lord Lovat, than whom I suppose there are few people at present who have more practical experience or more expert knowledge. They simply split upon the point of the authority. Now, I am bound to say—it is to be spoken about by others, but I do want to say—for my part—that I personally favour a Central Authority. It seems to me that if you have an authority, which will have forestry as its one and only business, that authority will push on forestry, whereas the Board of Agriculture and Fisheries, the Board of Agriculture for Scotland, and the Board of Agriculture in Ireland are very much occupied with other business, principally agricultural, the improvement of stock and other kinds of things, and I do not see how you could expect such Boards, with the best will in the world, to push on all these things so well as one which devotes its whole time and energy to one object.

"As to the cost, the Committee have gone into this carefully and have estimated that an expenditure of £15,000,000 would render this country safe from any danger of famine as regards the mines in forty years, and would render us independent of all foreign supplies for housing and shipbuilding at the end of eighty years. Now that is a very important thing. If a committee, constituted as this one is, unanimously decided that the adoption of their scheme will safeguard this country from any risk of timber famine by the expenditure of some £15,000,000 spread over forty years—which, after all, is what we are spending in two days just now—I think Parliament can hardly refuse to carry out the recommendations that have been made. The country owes a debt of gratitude to this Committee for the very able way in which they have laid their recommendation before the public, and I can only hope they will be adopted and put into force as soon as they possibly can once this war has come to a conclusion."

Sir John Stirling-Maxwell, Bart., said:—"I welcome the chance of saying a word on the proposed Central Authority, because discussion on that subject has shown that there exists a good deal of misunderstanding in regard to it. No responsible person has, so far as I am aware, suggested that we should dispense with such an authority, but some critics of the proposal in this report have glossed over the fact that such an authority is already in existence and resident in London. That authority at present is the Development Commission, of whom I am very glad to see one of the members, Sir William Haldane, here to-day. This Commission, so far as Scotland is concerned, has had since its establishment complete control of the only funds available for forestry and therefore of the policy. The Reconstruction Committee asked the Development Commission for a record of its work, which after a certain amount of hesitation they were good enough to provide."

Sir William Haldane here said:—"I am not aware of that. May I rise to point out—I am very sorry, indeed, to interrupt, but I came here, and probably others too, with the full desire and intention of supporting the resolution, which we thought had been so adequately prepared by Sir Andrew Agnew as to avoid these questions which do not make for harmony."

Sir Hugh Shaw-Stewart replied:—"We will be favoured by Sir William in his turn after Sir John has spoken."

Sir William Haldane.—"I merely want to point out that this question of the forestry authority does not arise out of this resolution. It is a scheme of afforestation we are discussing. Who is to carry it out is another matter."

The Chairman.—"I should have preferred to have this first and then go on to the discussion afterwards."

Sir William Haldane.—"The resolution as it stands is one that we can all accept, because it is approving of a scheme of afforestation which is definitely set out in the report, and which does not touch the question of the forest authority, a moot question as to which there has been a certain amount of discussion, and it seems a pity to bring all that in again."

The Chairman.—"It is all on the printed programme."

Sir William Haldane.—"It is not in the resolution."

The Chairman.—"I agree. However, I should be quite willing to put the resolution to the meeting and discuss this afterwards."

Sir William Haldane.—"That is what I think should be done."

The Chairman.—"I think there is something to be said for that. Would the meeting prefer to have the resolution put to them, which could be passed, and then we could go on to the discussion of the whole report afterwards?"

Sir William Haldane.—"I cannot be here in the afternoon. I am going away to keep an engagement made before this meeting was called, and if you put the resolution in that way, I should much like in a single word or two to express my support of it."

Sir John Stirling-Maxwell.—"I think I had better go on. I may say, as a member of the Committee, that the proposal for a Central Authority is an integral part of their scheme of afforestation, and the whole thing was built upon it. I was specially invited to speak on the subject here, and the fact has been noted on the printed programme. I think Sir William ought not to take exception to the subject being raised, and I may assure him that I am not going to make a controversial speech.

"Since the Commission was established it has had complete control of the funds and policy of forestry in Scotland. The Commissioners were so good as to supply us with an account of their work, which we examined very carefully. Let me say in fairness that the Commission has been handicapped throughout its work by a system under which responsibility has been hopelessly divided and no room left anywhere for honest pride or independent endeavour. It is therefore no aspersion on the good intentions of the Commissioners to say that we found in their record no trace of a coherent policy, only a list of sporadic doles, and that forestry, put in the forefront by Mr Lloyd George when the Commission was established, had fared very badly as compared with other subjects, and that the bulk of the money expended on forestry had gone to Ireland while Scotland received very little. We came to the conclusion that forestry would never make progress as a passenger in a crowded omnibus, for that is what it came to, and we recommended that the central control should be transferred to a real forest authority composed of men versed in the subject, ready to make it the work of their lives, and stand or fall by the result of their labours. The need for such a central control is proved by a

glance at the work which will fall to it. First, it will have to face the whole question of timber supplies in relation to imports, to the world's decreasing reserves, and to the resources of the British Empire. Next, in the matter of education, order will have to replace the present chaos. This country, with 3,000,000 acres of wood, has no less than six schools for the higher teaching of forestry. France, with seven times the area, finds one school enough. Scotland, as we all know, has no school at all for the training of practical forestry, though it has been asking for such a school for thirty years.

"Then there is the question of the survey, which must be uniform throughout the country, and the question of the allocation of funds and of afforestation schemes between the three kingdoms, which must be kept free from political bias, and made with a single eye to production. Once more, to take a last example, the work of research must be co-ordinated for the whole country if it is to give the best results. The Committee saw clearly that the practical work would have to be separately organised for each of the three kingdoms. It suggested as the ideal scheme three branches under the direct control of the Central Authority. This may be a council of perfection. We have to face the fact that the Board of Agriculture is now responsible for forestry, and personally I am disposed to hope that the development of their forestry branches may supply the desired machinery. I am much confirmed in that hope by the frank and welcome admission of the Secretary for Scotland, repeated by Dr Greig to-day, that the Forestry Department requires to be strengthened on the side of forestry, and is to be so strengthened.

"There is a great deal to be said for linking up forestry with agriculture, especially during the creative stage, but two conditions are essential—first, that the present disastrous division of responsibility should be avoided, that certain persons should be definitely responsible for certain branches of the work; and secondly, that forestry should no longer occupy an inferior position as the Cinderella of the agricultural departments, or be allowed to wither as it does under the very fatal neglect—perhaps neglect is too mild a word—of those whose time is more fully engrossed in the important subject of agriculture. Freed from these disabilities, and with its staff sufficiently strengthened to deal with a great national undertaking, I see

no reason why the Board of Agriculture should not, in conjunction with an intelligent Central Authority, realise the hopes which foresters in this country have so long entertained."

Sir William Haldane.—"May I be allowed to speak, as I have to leave?"

The Chairman.—"I am afraid it is time to adjourn, but if the meeting wishes to hear you, I have no doubt you will get an opportunity to speak."

Sir William Haldane.—"I will be very brief. I do not wish to detain the meeting at all."

Sir John Stirling-Maxwell.—"I would like to propose that Sir William should speak now."

Sir William Haldane.—"I feel a good deal of hesitancy under the circumstances in saying much, and I shall be as brief as possible, but I feel that the Commission to which I belong has been attacked to-day—not, I should say, in an unfriendly way; for I think Sir John withdrew or modified a good deal which was apparently in his mind, and I appreciate that very much indeed. But perhaps I may be allowed to make this observation,—Sir John seems to be under the impression that the Development Commission have never had any policy with regard to forestry. If there is one thing it has had a very clear notion about, it is the way in which forestry in this country must proceed. It has urged, as he knows, and as he has told us on other occasions, primarily an educational policy, but alongside that practical progress was encouraged by us as much as possible, and has been up till now. It is a very interesting thing, and makes it all the more pleasant for me to support the resolution which Sir Andrew Agnew has proposed, that in the details—I think I might say nearly all the details—that came under us as Development Commissioners, the Reconstruction Forestry Committee has followed on the lines which we recommended, and which we have pressed from time to time on the different departments of the Government.

"Take, for instance, the leasing scheme and the proceeds-sharing scheme, which Dr Greig has explained so clearly to us to-day. That scheme, as most of you know, was strongly advocated by the Development Commission years ago and pressed on the Department. The proceeds-sharing scheme I feel a certain personal interest in, because, as our Secretary, Mr Galloway, was showing me the other day, it is exactly ten years

since I brought this scheme before the Society in a paper published in the *Transactions*. I had the curiosity to look at it, and I see that it was almost word for word the same scheme that the Reconstruction Committee has now put forward, and which I am very glad to know is being furthered by the Board of Agriculture. I may say, personally, that I think this is a thoroughly sound scheme. Forestry is a difficult matter, but I think the best solution is in the endeavour to secure co-operation between landowners and the State in forestry, and I am myself recommending this wherever I have the opportunity."

Sir John Stirling-Maxwell.—"What about planting?"

Sir William Haldane.—"That brings me to this point. Sir John seems to think that the Development Commission itself can plant. We cannot plant a single tree, we have no power, and never had the power. Parliament drew up the scheme under the Development Act putting the whole executive powers in the hands of the different Government departments. All we have to do is to recommend financial advances on applications coming to us. We can, as we have done repeatedly and constantly, urge on the departments certain lines of progress, but it is entirely for the departments to say whether they will follow out these lines or not. In those cases to which I have referred, the departments had to decide the matter for themselves, no doubt under the influence of Parliament and the influence of public opinion. Public opinion is now aroused to such an extent on the subject of forestry that it looks as if now at last these proposals were going to be given practical effect to by the departments. We have to-day a most energetic Secretary for Scotland, who is throwing his interest into this subject in a way I think I may say none of his predecessors have done for a long time, not that they were not interested also. I think to-day we may look for real and substantial progress by the Scottish Board of Agriculture on the lines on which apparently we are all agreed schemes of afforestation should progress."

Sir Hugh Shaw-Stewart.—"I think Sir William's speech forms an admirable argument for the Development Commissioners being superseded by a Central Authority."

Colonel Fothringham of Murthly, speaking on how Scotland will be affected if the recommendations of the Forestry Sub-

Committee of the Reconstruction Committee are adopted, said:—"The chief recommendation of the Forestry Sub-Committee is that 1,770,000 acres should be planted in Great Britain, beyond the re-planting of the areas that have been cut down during the war or that are at present in existence. Many estimates of the amount of land that is more suitable for forestry than for other purposes have been made and they vary a good deal, but in all of them there is this similarity that at least half of that land is in Scotland, so that Scotland is more interested in this recommendation than other parts of the kingdom in proportion to its size, wealth, and population. On the assumption that half the area to be planted is in Scotland, it follows that 885,000 acres in Scotland would be planted during the period considered by the Sub-Committee, and, if their recommendation is followed, 590,000 acres would be planted in the next forty years, and 100,000 in the first ten years following the war. If their estimate of the amount of land suitable for forestry is anything like correct, there can be no doubt that there is plenty of land in Scotland for this recommendation to be carried out in addition to the areas that have been felled during the war, and any new areas that private proprietors are able and willing to plant; the difficulty arises in finding the money, the labour, and the housing for the men who will be employed in this work. For these purposes the Sub-Committee proposes that Parliament should provide the money, either entirely, in cases where the State acquires the land and plants it, or in part, where the owners make the plantations; from this it follows that one-half of whatever money Parliament provides should come to Scotland and be spent in developing the country. Up to the present time any money that Parliament has provided has not been distributed or spent in this way. The Sub-Committee also recommend that after demobilisation soldiers and sailors should be employed in making these plantations, thus providing healthy employment for the men who have gone to fight their country's battles. They have made no recommendation, so far as I can see, about the housing. The broad result of the adoption of the Sub-Committee's recommendations would be an improvement of the economic condition of Scotland and the provision of an occupation and the fostering of an industry that would bring an addition to the rural population, which has been neglected in the past much to the detriment of the country's welfare.

"It is easy to see the difference between the well-wooded valleys of the Spey, Don, Dee, and Tay and the bare and deserted condition of other valleys in Scotland that have not been planted, and when considering this difference of appearance please pause and think what a difference could be brought about by a system of planting such as is here recommended; the bare and deserted valleys would become clothed and inhabited, and would more resemble the more fortunate valleys where planting has been carried on in the past. Time does not permit of enlarging on this topic, but there is no doubt that an increase in the population and the productive possibilities of these valleys would be followed by an improvement in the means of transport and communication, roads, light railways, and even heavy railways being made to supply the needs of these districts that are at present undeveloped."

Mr A. D. Richardson, speaking on Education and the Training of Foresters, said:—"I am not an authority on education, nor do I profess to be an expert in any branch of the subject. I appear here merely as one who can lay claim to some acquaintance with the requirements of the practical forester in the way of technical instruction, and it is to that aspect of the question that I propose in the main to confine my remarks.

"When I joined this Society forty-five years ago, I was an apprentice forester. At that time the teaching of technical subjects in the rural districts was non-existent, and those of us who were able to acquire any knowledge of this sort had to acquire it by means of self-instruction. Since then education has made great strides in this and in other ways, and immense sums of money have been spent upon it; but when I look back over those forty-five years I must say that, with the exception of the single instance to which I shall refer immediately, I can find very little evidence of any provision in the way of technical instruction for the working forester in Scotland, and I think it may be truly said that in this respect he is now in practically the same position he was in fifty years ago. In recent years large sums have been spent on forestry education, but, generally speaking, the machinery which has been provided for this purpose is almost entirely outwith the reach of the practical man. He cannot take advantage of the instruction provided by the universities and colleges because, for one thing, he has

not got the necessary means to enable him to do so, and the problem therefore is—How is this kind of teaching to be brought within the reach of this class of man?

"So far as the higher teaching of forestry goes, England has, of course, been in advance of the other parts of the United Kingdom; but Scotland can, I think, lay claim to being the pioneer in the provision of technical instruction for the working forester. Twenty-five years ago, three years before the Society visited Germany, and years before the Forest of Dean School was started, a course of instruction for practical foresters and gardeners was organised by Professor Bayley Balfour at the Royal Botanic Garden in Edinburgh, and I do not think I exaggerate when I say that that course has made its impress on the forestry of the country. I know that we have here to-day head foresters and others who passed through that course, and I hope that they will give us their views on this matter when the general discussion comes on. I may state briefly that this course was devised to suit the requirements of both foresters and gardeners, and they had to produce evidence that they had had at least three years of practical experience before entry. It commenced with what may be called the fundamental sciences—chemistry and general physics, followed by botany, geology, meteorology, mensuration and land-surveying, entomology, book-keeping, forestry, and gardening, and there were lectures on special subjects in connection with forestry and gardening by experts. The course extended over about three years. The classes were held in the evenings, and the young men who attended them formed the garden staff, and were paid the ordinary wages of the staff at that time for their labour. It was an excellent course, and one on which any course of this sort might be modelled. The only two stand-points from which it might be adversely criticised are (*a*) that the foresters did not learn any practical forestry in connection with their work, and (*b*) that it might be argued with some force that it is a mistake to attempt to teach more or less tired students in the evenings. But the latter objection did not seem to apply in this case at any rate, for the men who passed through the course showed an intense eagerness to take full advantage of the teaching, and to make the most of the opportunity, in which they were much assisted by the use of a good library of books bearing on the subjects taught. In a

very few cases they had a little difficulty in following the subjects of the course intelligently owing to their elementary education being somewhat deficient, and this brings me to the real starting-point—the primary school.

"In order to take full advantage of technical instruction, a sound elementary education is, of course, a *sine qua non*, and it is a mistake to load the primary school curriculum with too many extra subjects. As a Nature Knowledge subject, in districts where it is likely to be of use, forestry might be substituted for some other subject of this sort; but to go further than this with forestry in primary schools, even where a considerable proportion of the scholars would be likely to take it up seriously, would only be to attempt to do imperfectly, and therefore expensively, what could be far more effectively done afterwards by the boy's instructors and fellow workmen. Continuation classes should be established in suitable centres for apprentices, and these should form, so to speak, the feeders for the demonstration areas, where properly organised courses of instruction would be found, and where the young men would receive their proper practical training. The demonstration areas would form the stepping-stone to the universities, and thus there would be provided a continuous and easy path from the primary school to the university, for which, of course, in the case of the working forester financial aid would have to be found. I have often heard the question—Should the practical training precede the theoretical, or *vice versa?*—discussed. I have no hesitation whatever in saying that if the two cannot be carried on concurrently, the practical training should invariably come first, and I go further and say that it should be commenced as early as possible. I am pleased to see that in the excellent report by the Forestry Sub-Committee of the Reconstruction Committee, the recommendations of which I am sure we all wish to see put into operation at once, a scheme of education on somewhat similar lines to this is recommended for foresters and foremen, and I trust that in the discussion of this part of the report what I have said here may be of some use."

Dr Borthwick, speaking on Forestry and the Education (Scotland) Bill, said:—"It is not my intention to criticise the Bill in any way, but to see in how far it will fit in with the aims and objects of forestry education. To begin with there

are two questions—first, when the training should begin, and secondly, what subjects should be taught. I entirely agree with Mr Richardson that one cannot begin too early. Forestry embraces such a wide field, and the rotation of a forest lasts so long, that a forester is always learning something new, and the more he sees of the full cycle in the life of a forest the more efficient he becomes. The Education Committee of our Society had this matter under consideration recently, and they were unanimously agreed that nature knowledge in schools might be taught, with forestry as the medium for nature knowledge. That would be taken up in schools in suitable forestry centres, not necessarily in every school throughout the country, but where the information was likely to be useful and appreciated. Then after having passed through this preliminary preparation for forestry training, certain schools in districts specially connected with forestry might have more advanced courses arranged. In order that teachers might be in a position to give the necessary knowledge, the Society endeavoured, and endeavours are being made otherwise through the agricultural colleges and the universities, to establish lectures for teachers who wish to take up forestry training from a nature knowledge standpoint. So far that will meet with the provisions proposed in the Bill. Another phase in forestry training, and one which the Minister of Education mentioned specially last year, was the desirability of establishing school camps during the vacation. Scotland has tried experiments in recent years in connection with school forestry camps, and they have, I may say unhesitatingly, been an unqualified success. These school camps might be established in forestry districts, and a certain amount of practical training be given in forestry. At the same time other exercises would be indulged in, games, etc., which would suit the scholars in a way which was obviously intended by Mr Fisher.

"After having finished with school, the next stage in the forester's training becomes the technical one of vocational training. What we want, and have wanted for some considerable time, is a school for practical foresters associated with a suitable demonstration area. This school would not replace any of the existing teaching centres; it would supplement them. Training in forestry covers such a wide field that it is only at the established colleges and universities that

the other subjects can be efficiently taught. A forestry school in connection with a demonstration area would be primarily for training in practical forestry, and that would be supplementary to the present educational institution. Now the provision of scholarships and the means of attending technical schools, continuation schools, agricultural colleges, and universities appears to be adequately provided for in the Bill, and as far as forestry is concerned it seems that this will be a very great help in the future training of foresters, giving, as Mr Richardson so well pointed out, an unbroken career from the very start right on to the university if necessary."

Mr Adam Spiers spoke on the Organisation of Native Timber Supplies. He said:—"The thorough organisation and development of the home timber trade calls for a good deal of consideration at the moment, when we see the enormous quantities of timber required for the supplying of our national needs. In the past all that could have been done has not been done. Most men who know tree culture are bound to admit that the country has been slow to realise the value and possibilities of our industry. We all know that our soil and climate can produce trees of large bulk, but they are often so badly grown that the trunk may be 10 to 12 feet long and anything from 18 inches to 48 inches in diameter, and then 5 to 20 tons of rough top, which no merchant wants, for the cost of labour is more than their worth. Do we not get here matter for reflection? For surely with care these trees should have given trunks three or four times the length, and more than double the value, and little or no rough wood—then we could hope for the development of the trade with increased prices to the grower, less labour to the merchant, and better results to everyone. There is nothing more wasteful of time and energy than the working of rough, useless wood. I am sure there is not a merchant among us who has not been told over and over again by the consumers of our converted material that, if we could supply timber well-grown, clean, and straight, the market—and a good one—would be waiting. Our country can grow the timber, but it must be cared for; many of our existing woods might yet be made to yield good results, if all the useless trees were cut out and only those left that are absolutely necessary for the growth and protection of the best. What we want is large areas in different parts of the country where the trade could see the possibilities

of steady supplies, so that a merchant would be warranted in laying down a mill alongside the forest, equipped with up-to-date machinery and appliances, where the timber would be sawn, dried, and manufactured on the spot, ready for the user; and this would mean a saving of 70 to 100 per cent. in cartage, railway, and other charges, which at the moment go so far to increase the price. Again, in the past little encouragement was given to the manufacture of the smaller wood goods, owing to the enormous quantities imported at prices at which it was impossible to compete; consequently much went to waste that should have given profitable employment. When we consider the enormous quantities of timber required annually by our railways and collieries, and also for ship-building, box-making, and house-building, one wonders why we have been so long in realising our possibilities; and, if we are to maintain our position among the nations, we must develop industrially, and without timber there is little hope. I am confident that if the timber is supplied, the trade will not fail to grasp the opportunity to develop an industry which would go far to supply the needs of the nation, and is capable of giving employment to large numbers of our people in one of the healthiest callings a man can pursue."

Mr W. H. Massie, who spoke on the Provision of Plants and the Importance of Preparation in Advance, said:—"In the report the Committee have devoted very little attention, only a few lines, to this subject, but they have told us that there is something being done, and that they have already provided plants for the planting of 5000 acres, which is all to the good. I think the most important thing about this part of the question is anticipation, that is, we should take long views, look ahead of ourselves a little more than we have done. It would be wise to give up the old method that many people had of beginning to look for the young trees a month or two before they wanted to use them, and then sometimes changing their plans and not wanting to have them at all. I have known many cases of that sort in my own time. It is a very simple matter after all to arrange for looking ahead if you are going to provide your own plants. If you prefer to go to someone who makes a business of producing them you say to him, 'I want a contract with you for so many hundred thousands or so many million plants of a certain class by a certain date.

Quote me your price.' The man immediately says to himself, 'This is good business for me. If I can arrange to do without the expense of selling, and without any fear of having to put them in the fire ultimately, I should be well able to turn the stuff out at a moderate price.'

"We dare hardly speak about Germans nowadays, but I am addressing a level-headed lot of Scotsmen, and I will say something about them. I visited the largest forest nursery in Germany two or three years before the war and was received with great kindness, and at the end I said to the man who owned the place, 'You have a huge stock. Is it not rather dangerous? Will you be able to dispose of all this?' 'Oh,' he said, 'the greater part of it is disposed of already. Orders are booked two or three years ahead, and then I can always depend on getting quit of my leavings on your countrymen.'

"The seeds, of course, are of importance, but we have never had very great difficulties with regard to that up to now, and I think if we are prepared to take advantage of bumper years, and store by when we have really a big crop of good seed, there should be no difficulty. We have heard from Dr Greig to-day that they have perhaps too many plants already. The scheme is to plant 250,000 acres in ten years, 25,000 acres a year, and Scotland should have at least 10,000 acres of that." (Colonel Fothringham—"100,000.") "Colonel Fothringham thinks we will have one-half, I am afraid we won't get the half. Take it at 10,000 acres, that means in the way of plants something like 35 or 40 millions. Now, I find in looking into the matter that the public nurseries of Scotland at the present time are quite capable of turning out considerably over that number, without taking into consideration those raised in private nurseries and what the Board of Agriculture is doing, so that really I think there is no great difficulty. On the other hand, we find professors recommending us to look to France for part of our supplies. I should think it was very unwise to depend on anything of that sort. Frenchmen will have enough to do themselves. Why should we not rather help them and let them draw on us for supplies? So it is entirely a question of land, labour, and trees, and I think it is a simple matter. I do not think we are so badly off for the men to carry it out. Those who come in contact with Scottish foresters know that they are as good foresters as any, and they have done up till

now what was wanted of them. Give them by all means technical instruction, and I have not the least fear but what they will do what is wanted of them."

Mr Gilbert Brown, Strathspey, who spoke on Forestry and Small-Holdings, said :—"In any large schemes of afforestation it will be necessary to provide for the maintenance of labour. The labour question will be one that will present a number of difficulties, but it is generally considered that a number of these difficulties can be overcome if the question of small-holdings is taken in connection with these schemes. Apart from the apparent benefits that afforestation would receive through small-holdings in supplying labour, the small-holdings are in themselves of great economic value to the country, so that it is not a one-sided affair. Throughout the glens of Scotland, where the soil and situation render certain places unfit for anything but growing trees, there will also be found on the lower levels adjoining these areas, tracts of land suitable for the creation of small-holdings. The Government have pledged themselves to create holdings, so in order to establish on the land a great number of men, it will be necessary to limit the size of the holdings, consequently some other work must be arranged for to keep the men employed. What more healthful and interesting employment could be got than forestry, or what more suitable employment could be given in conjunction with small-holdings? My own opinion is that no better labour can be got. I may state here that this is no mere opinion, but has been arrived at after experience in many other ways, and after having seen many demonstrations of their capabilities. On one estate the whole of the work was done by men from small-holdings. Even the foremen of the various departments were men of this class. On this particular estate, as on many others, forest planting had not been carried out for a considerable number of years, consequently very few of the men had any former experience in this class of work. When a forest-planting scheme, involving 150–200 acres yearly, was arranged it became necessary to train these men for this particular work. I must say they were very apt pupils and took a great interest in what was being done.

"They carried out all the work from the nursery to the woods. They prepared the seed-beds and sowed the seed with perfect uniformity, and also carried out the lining out of the

plants. In planting out in the woods, and for the first two or three years afterwards there was a certain amount of deaths yearly, and a certain amount of beating up required, but after that time, in Scots pine, larch, and spruce plantings deaths amongst the transplants were few and far between, so that little or no beating up was required, thus saving a considerable amount of labour and expense. I must say I would want nothing better. I may also state that they were very useful in road-making, draining, and fencing. As I have pointed out in this case, and I have observed it in others, it requires two or three years before the men get into proper touch with the work, and before the best can be got from them. In my opinion, therefore, I would deem it unwise to put trust in any large scheme of planting solely on casual labour. In the case just referred to the small-holders were men who had been brought up on the land, and whose people had been tenants of the holdings for a considerable period. They were thus accustomed to country life, and more or less accustomed to out-door work. On the other hand, if we establish men on the land who had no previous experience in this way, it will be some considerable time before they would be capable of doing useful work.

"The term small-holding, as meant here, would only consist of anything from 5 to 10 acres, and would not be of a size to keep a man steadily employed. My opinion is that the proper supply of labour will be more difficult to maintain and deal with than any other part of the scheme, and, unless something in the nature of small-holdings is arranged for, the afforestation of the waste lands of Scotland will be a slow process. It is to be hoped that the Government will tackle this proposition on sound principles and on broad lines. It would be a pity if a combined co-operative scheme of such vast importance as forestry and small-holdings should be wrecked through antagonism, but let us rather hope that there will be a better feeling between parties, with a desire to help forward without delay what is for the common good of the country in this matter."

Lieut.-Col. F. R. S. Balfour, Dawyck, said:—"I am asked to say something on the social and economic benefits that would result to this country if a comprehensive system of afforestation was established here, as recommended by the report.

"I have been for fourteen months in France in connection with the exploitation of French forests for the production of timber for the armies. My appointment by the War Office was as liaison officer with both the French military and forestry authorities, and I had singular opportunities of seeing something of the great part played by forestry in French national life. My duties took me to the splendid virgin forests of silver fir and spruce in the Jura, to the great State and privately-owned oak and beech forests of Normandy and the middle of France, and —perhaps more interesting than any other forest area—to the Departments of Landes, Gironde and Basses Pyrenées in the south-west corner of France. During the last 100 years this country has been converted from a barren waste of utterly unprofitable land to a huge forest of over two millions of acres, all under crops of maritime pine of varying ages. Had it not been for the foresight of the French authorities, and perhaps of Napoleon III. in particular, the armies and railways to-day in France and our Admiralty collieries in South Wales would have been in much direr need of timber than they actually are.

"This south-western area of France, which is now so enormously productive of useful timber, supports in its villages and small towns a thriving population, said to be more prosperous than any in France; they owe that prosperity entirely to the products of the forest. Certainly resin plays no inconsiderable part in this increment of wealth, but in spite of the distance from coal-fields, great sums of money pour into the country annually from the tens of thousands of tons of pit-wood shipped away, and the hundreds of thousands of sleepers produced by the excellent moveable band saw-mills scattered up and down the length and breadth of the three departments. You cannot go through that country without picturing to yourself what a lonely wilderness of heath and peaty marshland it would have been had its general afforestation not been taken in hand. There is no brighter prospect that afforestation in Scotland has to offer than the thought that in years to come we, or at any rate our children, may see a great rural population springing up among our valleys in prosperous and sheltered small-holdings, with ample occupation for their families and work for their horses; the hillsides around them clothed with thriving young timber up to tree-growing limits of altitude.

"The deer will have to recede to above the tree-belt, but we

may look forward to this diminution in their numbers with complaisance.

"I believe it is true that of civilised countries Great Britain and Turkey are the only ones which lack an organised Forest service. Let us hope that Turkey may soon be left in her splendid isolation."

The Chairman, in inviting a general discussion, said:—"I think we may congratulate the speakers that not one of them has exceeded his time. I think all of you will agree with me that one was amazed at the amount of matter they were able to get into such a short space.

"Might I just say a word or two myself? I think there are many points of interest, but of course we cannot discuss the whole thing. What seems the most important point is the question of the constitution of the authority. Unfortunately in this there seems to be some kind of idea that it is a personal matter. It is not a personal question at all. The whole question is that this afforestation scheme is to be carried out for the benefit of the country, and the only question we have to consider is what will be the best for the country. If any think that attacks have been made on them personally, it is not upon them but upon the system. This Forest service means a very large number of men, and they won't be all equal. Some may be better than others, but you must have encouraging prospects, and if you had one Forest service for the whole country is it not obvious that they would have a much better chance of promotion, and that you would obtain better men than if you had two or three different divisions? I feel that one authority for the whole country is far the best. Then it is said it must be at Whitehall. Why not in the North of England or in Scotland? There is no necessity for it being in London. When I was in the House of Commons —and anyone who has been there will agree with me—when grants were given to any particular purpose if England got £100,000, Scotland got an equivalent grant of roughly speaking about one-tenth. So I presume if we had one body in London and one in Edinburgh, for every £100,000 spent in England on forestry, we would only get £10,000. In Scotland there is a much larger area suitable for planting than in England, so that the bulk of the money should be spent here. That is what I think will happen if you have one authority, and that

is what I want to see. I think we shall all agree with what Dr Greig said about co-operation with the landowners. I do not, however, like the proposal for compulsory leasing. I think that is a proposal which is probably one of the blots on the scheme, though Dr Greig says it is very easy. If you are going to have compulsory leasing all over, I'm afraid you will find a great many people up against the scheme. And I think the Committee deal rather too easily with the question of taxation. If people are not satisfied with the present system under Schedule B they can go under Schedule D, but under Schedule D a person may be paying 63½ per cent. in taxes, *i.e.*, 42½ per cent. in income tax and super-tax, and 21 per cent. in death duties, and of course this taxation may increase. That is not a very encouraging prospect for anyone to consider. I do not think there is any other subject which has to pay both death duties and income tax. The real point, however, is to get this authority constituted, to give it powers, and to get it as soon as we can. I think Lord Lovat's separate report at the end sums up the question very well, and I am entirely in agreement with him.

"Colonel Stirling of Keir hoped to have been here to read a paper on Forestry Administration in France, and if the Meeting would like to hear it Sir Andrew Agnew is prepared to read it. I think it would be very interesting at the present time, and it is not long."

Colonel Stirling's paper was as follows:—"Though there may be minor differences of opinion on matters of detail, I think we are all agreed in this. We all wish to see a strong and efficient Forest service under a sound administrative system. In the five minutes at my disposal I propose to give a brief outline of the Forest Administration actually existing in a neighbouring country.

"I have chosen France because the facts are easily accessible, because the Forest service is an admirably efficient one, and lastly, because forestry is associated with agriculture under a single Minister, a plan which seems to commend itself to a considerable section of opinion in this country, and has the support of the Secretary for Scotland. But though in France forestry is associated with agriculture it is from top to bottom a distinct and separate service. This is an absolutely essential condition; you could never have an efficient administration

if officials were moved about from forestry to agriculture, and *vice versa*, in the course of promotion and at the will of the Minister.

"The Central Administration of forestry is constituted as follows:—There is one Director and three Administrators, each at the head of a subordinate department. All four of these high officials are nominated, not by the Minister but by the President of the Republic. This is a point of vital importance and one upon which the welfare of the service depends; there can be no security in a service in which the highest appointments are made in any other way than by the selection of the best available men by an authority possessing the complete confidence of the service. The Director and the three Administrators form the Forest Council, of which one of the administrators acts as secretary. In certain details connected with the creation and suppression of appointments and the nomination of candidates to the school for forest officers, the Director makes recommendations to the Minister of Agriculture. In certain minor matters, he acts on his own responsibility. All the chief business of the department is discussed by the Forest Council and afterwards submitted to the Minister. It is expressly laid down that the Director is bound to take the advice of his Council in all financial business and in controversial matters, so that in all important affairs the recommendation which he lays before the Minister is not his own but the deliberate opinion of the Council. This provision is another valuable safeguard for the interests of silviculture. A Minister who is a layman would incur grave responsibility in setting aside a decision of the Forest Council of experts in silvicultural matters. It is not possible to go into the details of the composition and duties of the subordinate departments of the Central Administration, but it is essential to remember that all the higher posts in the Central Administration are filled by officers of the active Forest service. As a consequence there is always close touch between the administrative and executive portions of the service.

"The extent of the forest area of France is 20,750,000 acres. Of this 11 per cent., or 2,282,500 acres, are State forests, 23 per cent., or 4,772,500 acres, are communal forests. The remaining 66 per cent., or 13,695,000 acres, are privately-owned forests. Supervision over privately-owned forests is confined to the enforcement of the law against clearance and of certain

precautions against fire. These duties cannot occupy much of the time of the executive staff. In the communal forests, the extent of State control is much greater; although in the lower ranks the communal service seems to be distinct from the State service, the higher posts are filled by officers of the State service. Taking the State and communal forests together, there is an area of rather more than 7,000,000 acres under the charge of forest officers of the State. The composition of the active Forest service is as follows:—There are 32 Conservators of forests, one for each of the 32 administrative districts into which France is divided. There are 200 Inspectors of forests, 215 Assistant-inspectors, and 300 *gardes généraux* or Superintendents. The duties of Conservators are clearly defined. They do not include questions of policy, which are dealt with by the Central Administration, but they give the Conservator a free hand within his own area in certain clearly defined matters. The Inspector is the executive officer for a limited district; associated with him there is an Assistant-inspector who replaces him when absent, and is essentially an out-of-door official. The Inspector and Assistant-inspector are charged with the execution of the working-plans under the direction of the Conservator of the district. All the officers of the Forest service receive their training at the Forest School at Nancy. The nominations of candidates to this school are submitted by the Director of the Central Administration for the approval of the Minister for Agriculture. The forest school at Nancy has great traditions, excellent facilities for demonstration, and the efficiency of the Forest service in France is largely due to the influence of this great school.

"The notes which I have given you are drawn from the *Dictionnaire de l'administration française*, by Maurice Block. I would commend a study of the article 'Eaux et Forêts' to all those who are interested in the creation of an efficient Forest Administration in Great Britain."

Sir Hugh Shaw-Stewart, speaking on the question of the forest authority, said:—"I do think that in view of what has fallen at different times from the Secretary for Scotland, and from Dr Greig to-day, it looks as if the authorities at present in Scotland are content merely with an amplification of things as they are, and I think as this is the Annual Meeting of the Arboricultural Society, if those of us who place real value on the

scheme of a Central Authority do not express ourselves to-day our opportunity will be gone. Let those who agree with the view that there should be a supreme directing forest authority for these three kingdoms make that clear to-day, especially in view of the interpolation of one of the Development Commissioners this morning, Sir William Haldane. I am sorry he appears to think the matter implies something personal to himself as a Development Commissioner. It is not that. What we complain of is that the only funds from which the Board of Agriculture can help us are the funds administered by these Development Commissioners. It is not their fault that they are not expert foresters. They were not placed there for that. It is not their fault that they do not give the Board of Agriculture as much money as they would like to give. They have to watch over those funds for the purposes of education and a heap of other things. It is not in their power to see that sufficient funds are set aside for the demands of the Board of Agriculture for forestry, and therefore it is really not a personal matter. But we want a directing authority for forestry purposes. Let that authority act through the Boards in England, Scotland, and Ireland. But the directing authority should be independent of these Boards so far as direction of plans goes.

"Lord Lovat has summed the matter up very well in his Minority Report. (I do not know if it is generally known that this Blue Book containing the report can be obtained for 1s. through any bookseller, and I advise people to get it.[1]) The first reason Lord Lovat gives for insisting on the importance of a Central Authority is to make a definite break with the past, to get out of the welter of conflicting authorities, and to escape from the arena of party politics, Royal Commissions, and amateur inquiries. It is to emphasise the view that Lord Lovat has so clearly put before us, that those of us who think in that way should take this opportunity of saying so, and saying that we ought not to be content with anything less."

The Resolution was then put to the meeting and carried unanimously.

Sir Hugh Shaw-Stewart suggested that the emphasis laid on the Central Authority should be put in the form of a motion, and he proposed that they express the opinion that the only way

[1] See *Transactions*, Vol. xxxii., Part 1, p. 97.—Hon. Ed.

in which these recommendations could be efficiently carried out was by the formation of a Central Forest Authority for Great Britain and Ireland. It was pointed out, however, that no notice having been given the motion could only be taken up at a special meeting, for which there must be a requisition from forty members. More than forty members expressed a desire, by a show of hands, for such a special meeting, which it was accordingly agreed should be held.

Sir John Stirling-Maxwell said:—"There is one duty I am sure you will all want to join in performing before we separate, and that is to pass a hearty vote of thanks to our retiring President, Sir Andrew Agnew. The Duke spoke of his pen, and there is no doubt that his pen has been a great help to us, but I think he has helped us even more by his wise counsel during the last two critical and trying years."

Sir Andrew Agnew.—"I am extremely obliged to all of you for the very hearty and far too flattering way in which Sir John has proposed this vote of thanks, and the exceedingly cordial way in which you have all received it. I can assure you I look upon it as a very great honour to have been President of this Society during the last two years, and I only wish I had been able to do more than I have done for it. If I have to any extent satisfied your wishes in the matter, I am sure that I owe it mainly to the very kind support that I have received from the Council and from all the members of the Society. No one could have had a pleasanter Council to work with than I have had. We have had altogether most harmonious meetings. I should like to take this opportunity of thanking all my colleagues in the Council for the assistance they have given me, and for the consideration they have shown me in the two years I have been President."

The Chairman, in congratulating Sir John Stirling-Maxwell on his appointment as Assistant Timber Controller, said they were fortunate in having Sir John in this office, for they could rely on him being absolutely straight and fair to everyone.

12. The Special Meeting of the Society: The Central Forest Authority.

In accordance with the desire expressed at the Annual Meeting, a Special Meeting of the Society was convened on 15th March, in order to bring before the members a resolution in regard to the establishment of a Central Forest Authority.

At this meeting Sir Hugh Shaw-Stewart said:—"Before asking your President to place this resolution in your hands, I think it would be well if I dealt for a moment or two with the objections to the idea of a Central Authority for forestry that we hear occasionally.

"The only real objections that I have heard are these—that by establishing what those who agree with me want, viz., a Central Authority for forestry pure and simple with full powers, we should be creating a new body additional to all the many bodies that are ruling the country more or less just now. There is the further objection, that this new authority would either over-ride the local Boards of Agriculture which already have some schemes on hand, or, if the Central Authority is associated with those Boards of Agriculture for the three countries, then you would have all the drawbacks of dual control. In regard to the last objection, do not let anyone suppose we have not got all the evils of dual control now. I turn to the report in the Appendix (page 91) of the Blue Book, and I find that they say: 'Early in 1914 the Board of Agriculture submitted a proposal for the purchase of an estate in Aberdeenshire on the initiative of the Board of Agriculture. The Commissioners carefully considered the proposal, but could not regard the locality as suitable,' and so on. Very well, that of course put an end to that. Later in the year the Commissioners framed an alternative scheme, which we may call the Dunkeld scheme, for acquiring about 4000 acres, and they go on to specify that. Then the end of the paragraph says: 'The Commissioners were willing to set aside a total sum of £150,000 to finance the scheme if it were adopted by the Board. The scheme was not, however, accepted by the Board, and the whole question is therefore at present in abeyance.' Now there in that single paragraph you have very vividly presented all the evils of the dual control that exists at this moment

and has existed for some years past, which some people oddly enough wish to continue.

"Let me say a word on these two bodies who have the dual control of forestry in Scotland at the present time. I do not know whether there is any representative of the Scottish Board of Agriculture here or of the Development Commissioners. I would very much sooner say anything I have to say in their presence than behind their backs, but they have had every opportunity of attending this meeting. I would like to say a word first regarding the Development Commissioners. On page 11 of this Blue Book there is set forth a statement showing the sum total of advances from the Development Fund recommended to the Treasury up to the 31st March 1915. I mention those to remind you what a number of matters of great importance have to be dealt with by the Development Commissioners, quite apart from forestry. There are agricultural and rural industries with a grant of over £1,000,000. There is a forestry grant of £67,000. Then there is Reclamation and Drainage of Land, Rural Transport, Harbours (which item alone has an enormously greater amount of money set apart for it than forestry), Inland Navigation, and the important subject of Fisheries. Thus forestry is only one of a number of important subjects with which it is their business to deal. When they come to deal with forestry one naturally looks with anxiety at the list of the Development Commissioners to see if there is anybody, or if there are many people, on that Board specially acquainted with forestry. I have heard two names mentioned as specially qualified to advise us how to manage our forestry in Scotland with the help of the Scottish Board of Agriculture—Mr Wilmot and Sir William Haldane. I have not the pleasure of Mr Wilmot's acquaintance, but I understand that his forestry knowledge has all been acquired in India, and so far as I am aware he has no special knowledge of Scottish conditions. The other gentleman, Sir William Haldane, I am perfectly ready to admit, and I gladly admit, shares the remarkable ability of his family—and no one admires Lord Haldane's schemes in dealing with the army more than I do, honestly—but I entirely decline to accept Sir William Haldane as an authority on forestry in Scotland or anywhere else. I have never heard of his nurseries or of any timber sale on his estate. I am told that he manages other people's estates. Of course you can acquire a good deal of

knowledge by managing other people's estates. But it is a very different thing to advise other people, and to pay for your own mistakes yourself. The little knowledge I have of forestry I have slowly and laboriously acquired during over forty years, because it is over forty years since I first inherited an estate in Stirlingshire. One of the first things I had to do was to see what trees should be sold and what planted, and I have been steadily for many years attending to that matter both in Stirlingshire and afterwards in Renfrewshire. It is only by season-to-season, by almost monthly, attention to what you are doing, either planting or cutting, that you can see your results very slowly, and it is only by paying yourself out of your own pocket for your mistakes, and by sometimes getting a little money put on the right side of your account for your occasional successes, that you really have anything more than a bowing acquaintance with forestry. Of course such knowledge as I possess is very much below the knowledge of those who passed forestry examinations and made a study of it in early life, and I have never heard that Sir William Haldane has done that.

"Now about the Scottish Board of Agriculture—something over 90 per cent. of the woodlands in Great Britain are in private hands, and anything that we are told about forestry must come from an authority which proprietors can respect as regards their knowledge of what they are talking about. Now, in saying what I am going to say about the Scottish Board of Agriculture, I do not wish to attack their policy on agricultural lines. I know, as convener of an Agricultural County Committee, they have done many things wisely and well during the last two years. I am not dealing with agriculture but with their management and advice on forestry questions. I would just mention one matter, which shows how very impossible it is for proprietors or for anyone else to have confidence in their policy as regards forestry advice. There is a lecturer sent about the country by the Scottish Board of Agriculture. I have never seen him, but I have read reports of his lectures in the papers, and I understood that his activities had been put an end to because they were so obviously astray, but, to my astonishment, as lately as the end of February, I was told that this gentleman was sent down by the Board of Agriculture to lecture to an important Pensions Committee in

a very large county of Scotland, that he took up half an hour of their very valuable time—for they had come from all parts of the county—in explaining to them what he held out to the discharged soldiers as to what they might expect from devoting themselves to forestry. My friend told me that the lecturer actually told this Pensions Committee—and it would not have mattered if he had been speaking on his own behalf, but he was speaking for the Scottish Board of Agriculture—he said something like this, that a discharged soldier without any previous forestry experience, who devoted himself to forestry work for fifteen months, would be qualified to take a place as a leading forester at £150 a year. That was told me by a gentleman who is very careful what he says, and I ask anyone who knows anything about learning the work of forestry, either as under forester or head forester, whether that man was not talking the most absolute nonsense. So much for our confidence in this branch of the dual control that governs our affairs.

"I want to quote another page from this Blue Book, that is, from the Minority Report of the only Commissioner who did not agree with the majority. He was a Treasury official, and it is interesting to see what his alternative was to the scheme put forward by the majority of his colleagues. On page 72, he points out what he thinks are the difficulties which would not be solved by the institution of a single authority, and he goes on, 'But I see no reason why, if the control of operations be left in the hands of the existing departments, suitably strengthened for the purpose, the programme for each year should not be determined by means of a Joint Committee, consisting of the heads or selected representatives of the three departments. And assuming that Parliament is prepared to vote an amount to cover afforestation operations over such given period, it ought not to be difficult to apportion for the purposes of an estimate the amounts which would be required by each department for each ensuing year. Any amount which might be voted by Parliament to meet the needs of the Board of Agriculture (England), Board of Agriculture (Scotland), and Department of Agriculture (Ireland) over a period of years would then be drawn upon by each department to the extent recommended by the Central Committee' (which obviously means the Joint Committee that he has just mentioned), and

he also adds, 'and approved by the Treasury.' Well, we know that Treasury. But observe, he then has to get a Central Authority. How does he get it? By combining the three representatives of England, Scotland, and Ireland. They are to decide where the money is to be spent. That means the old story of the equivalent grant for Scotland, England, and Ireland. That is obviously unworkable for our purposes, but it is interesting because it is the only alternative scheme that I have seen. Should we go on as we are now under this wretched dual control, or take this Treasury official's scheme, which would to my mind end in smoke, or come back to what I am to recommend in the motion I shall move? We do not want, in moving for this Central Committee, to divorce forestry from agriculture. We do not want the agricultural interest to be neglected. Why, in your own statement, which is in the Appendix, you say, at page 78:—'It is generally admitted that the creation of small-holdings, where there is a prospect of their being profitably worked, is an object of importance on national grounds, and we are of opinion that in Scotland small-holdings would be most profitably worked in connection with afforestation.' Certainly we all think that. There is no reason in the world why, if you have a Central Authority of sensible men, they should not consult the Boards of Agriculture of each country, or why they should not work to some extent through them. As long as they keep all that is good in the local administration and consider local circumstances, the Central Authority might perfectly well make use of such machinery as exists, but for any sake do let us have the chief direction in responsible hands which have also control of the funds. I would just like to say, speaking of the Board of Agriculture, that a great deal has been made of a resolution passed by the Chamber of Agriculture supporting the existing state of things. The farmers of Scotland are said not to want to see forestry divorced from the Board of Agriculture because they think they would suffer. I know very well what the feelings of most of the farmers on forestry are. They do not want to see single trees spoiling their crops. Quite right too. They do not want to see trees in hedgerows. They like shelter-belts. Though I doubt if a farmer had a shelter-belt of ripe timber, and was told that the timber ought to come down now or deteriorate, I rather

think the farmer would say, 'Let it wait till my lease is up.' And as regards woodlands, I think the average farmer looks on woodlands as a sort of gathering-place for wood pigeons and game. I do not think he bothers his head about the true interests of forestry. By all means let us please the farmers. We feel with the farmers that landscape gardening is not forestry, and we do not want to propagate fads or fancies. No forester in his senses wants that. Now, I conclude by saying that if the Central Authority is to use the Boards of Agriculture—and I do not see why it should not to some extent—we must see that the Forestry Authority is endowed with the real control of forest policy, that it has some say in the personnel of the forestry sections of the Board, so that it may be impossible for the permanent officials to make forestry any longer the Cinderella of the departments. We want something like the method in France, though somebody else better qualified than I could tell you how the French manage these things. We therefore ask for a Central Forest Authority to deal with that subject alone, with sufficient knowledge and experience to command confidence, free from party politics, and endowed with adequate powers and funds. It should be the duty of this authority to formulate a comprehensive forest policy for the United Kingdom to organise research, to direct and co-ordinate forest education, to allocate funds for schemes of afforestation, and to encourage and assist private enterprise. I beg to move the following resolution:—

> 'That this Meeting of the Royal Scottish Arboricultural Society, specially convened, hereby approves of the recommendations of the Forestry Sub-Committee of the Reconstruction Committee, and particularly of the recommendation that a Central Forest Authority, equipped with funds and powers, be created for Great Britain and Ireland, and urges the Government to carry these recommendations into effect without delay.'"

Mr Robert Forbes, Kennet, said:—"I rise to second this resolution. I think by this time forestry has proved itself of sufficient importance to deserve a Central Authority of its own, but I do not think it matters very much where that authority is located, whether it is in London or in Edinburgh, so long as we get it entirely free of any other department."

Mr W. H. Menmuir, Edinburgh.—"I rise to move an amendment. This meeting should have been called to discuss the question of a Central Authority, instead of putting this resolution before us to be voted on by a yes or no. As Sir Hugh Shaw-Stewart made a certain number of remarks in favour of a Central Authority, I may be permitted to make a few remarks against it. This question of a Central Authority for the three countries is of great importance to Scotsmen, because I am rather afraid it would mean that the Central Authority would be in England, presumably London. Now, if we are to have a Central Authority for forestry at all, it ought to be in Scotland, a National Authority. We have to take into consideration the different climatic conditions, the different system of land tenure, the crofting element, and the different kinds of trees that we grow here. We must certainly have not only an Administrative Authority in Scotland but an Executive. When we talk about Central Authorities we must, at the present moment, use the word English, because, although the term of Central Authority has been used, it actually means English Central Authority."

Sir Hugh Shaw-Stewart.—"I never said a word which would lead to that conclusion. It is quite different to what I intended."

Mr Menmuir.—"Well, I withdraw that, but it leads one to infer it. However, putting that aside, I think we have sufficient experience of English Central Authorities in railways, education, and tramways. I beg to move 'That a Central Forest Authority be appointed in Scotland for Scotland, a Scottish National Authority.'"

Mr W. E. White, Hamilton, said:—"I do not think Sir Hugh has shown any good reason why we should not have an authority in Scotland. Scotland will be swept aside between England and the other countries."

Sir Hugh Shaw-Stewart.—"What I was arguing was that Mr Bromley, in his Minority Report, while he does not advocate a Central Authority, advocated a Joint Committee, which he called a Central Committee."

Mr White.—"I understood you were in favour of a Central Authority to deal with forestry matters for the three countries, but no separate authority for Scotland. Is this Central Authority to have control of forestry in Great Britain and Ireland to the exclusion of every other?"

Sir Hugh Shaw-Stewart.—"It is to be supreme, but there is

nothing in common sense to prevent their acting in their Executive through the Boards of Agriculture in England, Scotland, and Ireland in order to get at the local conditions."

Mr White.—"But it is to be a supreme authority. I think it is a retrograde movement for Scotland, and I have pleasure in formally seconding the amendment."

Colonel Stirling of Keir said:—"My Lord Duke, if I may be allowed to say so, I think that your decision to refer the resolution approving the report of Mr Acland's Committee, once its exact scope had been questioned, to a special meeting of the Society, will meet with the warm approval of the members. This decision was quite in accordance with the best traditions of the Society. We have been in the past, and I hope we shall continue to be in the future, a singularly harmonious and united body; and it was far better to delay the resolution, important as it is, rather than that any member of the Society should be able to complain that a meaning other than that which it represented to him had been read into the resolution. For my own part, I think that the original resolution covered the whole ground of the Sub-Committee's report, and that the administrative proposals, which are a vital part of the recommendations, could not be separated from them. But since the opposite opinion has been expressed, those of us who believe that the time has come to set up an adequate Administration of Forestry in this country welcome this occasion of supporting our belief. I am here really to make a plea for unity. I think from what has been said by the proposer and the seconder of the amendment that we are really not very far apart in essentials. Perhaps, if you will do me the honour to listen to my argument, we may find something that will bring us closely together. Now, the view has been expressed by deputations, not perhaps exclusively representative of silvicultural opinion, that the Administration of Forestry in Scotland should remain in Scotland and under the control of the Board of Agriculture. It is only with the latter part of this suggestion that any of us will disagree. I will give my reasons for doing so presently. With the desire to have Scottish control of forestry in Scotland I am in complete sympathy, and I believe that it can be shown that Scottish control of our own forest area is in no way incompatible with a single Forest Administration for Great Britain, and, if possible, for Ireland as well.

"Great Britain hitherto has had no Forest Administration, and no Forest Service worth speaking of. We have to look abroad if we are to find a model of efficient machinery for carrying out the improvements which we all wish to see made. At the previous meeting, I was allowed to submit a paper explaining my reasons for wishing to follow the main lines of the French system. I will not go over that ground again except so far as may be necessary to keep before us the comparative size of the forest areas with which we are dealing. France, with a forest area of more than 20,000,000 acres, with a greater range of climate and variety of timber trees, and with racial differences not less strongly marked than our own, has a single Forest Authority and a single service. According to our somewhat unreliable statistics, the forest area of Great Britain and Ireland is very little more than 3,000,000 acres, probably considerably less at this moment; and even with the addition of 1,770,000 acres recommended by Mr Acland's Sub-Committee, our whole area will still be less than a quarter that of France. Is it wise, is it necessary, is it economical, is it efficient, to divide this small area between three separate Forest Administrations and three separate Forest Services? Let me give a single point, in particular reference to the Forest Service.

"It is probable that whatever the organisation may be, a considerable proportion of the future forest officers in Great Britain and Ireland will be Scotsmen. Many of our best men are holding appointments outside Scotland to-day. Do we wish to set up a system of water-tight compartments so that these men, once in the English or Irish service, will find it difficult to return to Scotland? I think not. By all means let us send our young men to England and other foreign countries where their abilities will gain for them the positions which they deserve; but don't let us bar the door to their return to Scotland, by setting up against them the barrier of a small independent service. Perhaps it may be said that we have three Boards of Agriculture, and therefore we must have three Forest Administrations. I don't admit the validity of the argument. Why should we make the errors of the past into precedents for the future? It is not an universal precedent; besides our one Navy and one Army, always in our minds and hearts, we have one Board of Trade, one Ministry of Labour, and so on. The creation of three Boards of Agriculture belongs to smaller times

than these. When it shall please God to end the war, we shall strive to build many things anew, and to build them better. Here at least in forestry we have a site unbuilt upon, uncompromised. Let us try to put in good foundations and to build upon them something that will endure.

"One word as to the relations between agriculture and forestry. In reply to a recent deputation, the Secretary for Scotland said that forestry is the hand-maid of agriculture. In justice to Mr Munro it must be remembered that he was speaking to a deputation not of foresters but of farmers. But with all deference I demur to Mr Munro's definition. Forestry is not a hand-maid or a maid-of-all-work, or any other sort of maid. It is a national industry, with independent interests which touch at many points those of agriculture, and sometimes come into sharp conflict with them. It is the task of those of us who are concerned equally with both agriculture and forestry to try to reconcile this conflict of interests, and I think you will agree with me that we cannot do it by putting either the forester or the farmer in exclusive control of our policy. Now our experience on a small scale is certain to arise on a much larger one. It is certain that differences of opinion and of interests will arise between the Board of Agriculture and the Forestry Administration, and it is no solution of the problem to give the last word to the Board of Agriculture. When there is serious disagreement as to policy, it should be for the responsible Minister or, on grave issues, for the Cabinet to decide between the two departments. Let us return for a moment to the example of France. There forestry is associated with agriculture (and in my judgment rightly associated) under a single Minister. But the two departments are absolutely and entirely distinct in personnel from top to bottom. The higher appointments in the Forestry Administration are made not by the Minister but by the Chief of the State. The Director of forestry, and he alone, is responsible for the Forest Service. By all means let forestry be associated with agriculture, but let us have clear ideas, and don't let us think for an instant of putting the Administration of Forestry under the control of the Chairman of the Board of Agriculture. There is a perfectly natural place inside our existing system for the chief Administrator of forestry. He should be on an equality with the Chairman of the Board of Agriculture, and like him responsible to the

Secretary for Scotland. Time does not allow me to indicate how this Administration of Forestry in Scotland could be linked up with the Central Forest Authority, but I don't believe that there is any insuperable difficulty in this. I have trespassed too long on your patience. Let me say this word in conclusion. This question will have to be decided for good or evil in the near future. There could be no better support for the case which I have tried to make out than the unanimous adoption of the resolution before the meeting."

The Chairman.—"I am afraid I will have to leave the meeting shortly. We intended to have had the meeting on Wednesday, but we had to call it for Friday, and I had another engagement. When I vacate the chair I will ask Mr Massie to take it in my place, and I would only ask the Society to be kind enough to excuse me. Perhaps Colonel Balfour might tell us something about France."

Lieut.-Colonel Balfour of Dawyck said:—"I have been in close contact since October 1916 with French methods of forestry, and for many months attended bi-weekly meetings with the forestry authorities in Paris. As has been said here to-day, the head of the "Departement des Eaux et des Fôrets" is in Paris, and his service, like that of any other great Government office, is entirely centralised there. There are in different parts of France what are called "centres de bois," which have charge of the State forests and all forestry matters in their neighbourhood. For example, the "Centre de Bois" at Rouen deals with the forests of the lower valley of the Seine; Orleans with those of the Loire and the great national Forêt d'Orléans; Besançon with the coniferous forests of the Jura Mountains; Bordeaux with the maritime pine forests of south-west France; and there are others. All these "centres de bois" have their officer in charge with his staff of subordinates, and he is in almost daily communication by telegram and telephone with the head of the service in Paris. I cannot conceive how the Forest Service of France could be conducted if the officer in charge, say, at Bordeaux, acted independently and under a different system of organisation from, say, the service at Nancy. They must be co-ordinated in one Central Authority. That is the system that obtains in France, and I cannot see that we can do better than follow the example of the French, who, after long experience in the scientific working of forestry matters, have

found centralisation under one authority to be the best, and in fact the only, workable system."

Mr E. P. Stebbing.—"I think we are rather in danger of losing sight of the point which we are all interested in, and that is the matter of putting in the trees. It is thirty-three years since the first Commission considered this question, and not a single tree has been put in. The present position, as I understand it, is as follows. The Secretary for Scotland has announced, as Dr Greig explained at our last meeting, that the forestry side of the Board of Agriculture has been re-organised so as to proceed with schemes of afforestation. I understand that the Board of Agriculture is now engaged in preparing important afforestation schemes in different parts of the country. This being so, it does not appear to be to the interest of Scottish afforestation to upset these schemes and thus put back the work of getting in the trees, which is really what we are all interested in. I would suggest that we should be willing to assist these schemes so as to get a commencement made with the really important matter of getting trees into the ground, which has not been accomplished yet."

Sir Hugh Shaw-Stewart.—"Because the Board of Agriculture has not got the money."

Mr Stebbing.—"I suggest the following motion: 'That it is expedient that the Society should give their support to the policy of projected afforestation in Scotland, which the Secretary for Scotland and the Board of Agriculture have now actively entered upon, and that any action taken in a contrary sense would only delay progress.'"

Mr A. D. Richardson.—"I submit this is not a competent motion. The question here is the motion on the billet."

Mr Menmuir.—"We have been told the Central Authority in France is in Paris. We must consider that as a national affair; therefore the Central Authority for a Scottish scheme ought to be in Scotland. No matter what the Central Forestry Authority in Scotland be, in combination with the Board of Agriculture or not, it is sufficient that we have in Scotland a properly equipped National Forestry Authority. That is what we ought to have."

Mr H. M. Cadell of Grange.—"It appears to me by adopting the motion we are asked to adopt, we are going to vote away any power we have to set up a Central Authority in Scotland,

and be worse off than before. What we want to do is to get on with the planting of trees. If we vote our power away to some Central Authority the money will go to Ireland and England, and we will get none at all. That is always what happens. Ireland gets everything, but Scotland gets nothing. This motion of Sir Hugh Shaw-Stewart's wants one amendment, namely, that if there is a Central Authority in London, there ought to be in Scotland and Ireland branches such as there are in France."

Sir Hugh Shaw-Stewart.—"That is understood."

Mr Cadell.—"It is not conveyed in the motion."

Sir John Stirling-Maxwell.—"This motion contains nothing relating to the executive powers in the three kingdoms, but it has always been assumed that the actual carrying out of forestry must be done locally. There is no question about that. The motion, with which I entirely sympathise, does not commit this Society to deciding whether the Board of Agriculture, of whose activity Mr Stebbing has just now spoken, or some other new body should be the executive body in Scotland. That matter, which is very controversial, and, I may add, also very difficult, is left undecided by this motion, and we are merely recording our opinion that any great national departure like a scheme of afforestation, instead of being divided into three water-tight compartments, should concentrate all the skill we can find to direct the whole movement. That is the sense of the motion. I was very much struck by the spirit in which the mover of the first amendment put his amendment, and also by the way it was seconded. What struck me was that neither was defending the old regime from which we all wish to escape. They admitted, as any sensible person must admit, that our administration in forestry has been a total failure. They wish to get away from the past too. I would commend this to their attention. I do not stand here with the object of criticising the Board of Agriculture in Scotland, but I do appeal to anyone who has watched that Board and knows how things have developed in this country, whether that Board is not, compared to the corresponding Board in England, a very small and a very powerless thing. The English Board, working with a larger staff on a larger scale, with more power of research, and with a larger number of experts attached to it, is doing work far wider in scope than anything our Board here can

possibly attempt. It is a small, humble thing this Board in Scotland, and if it does its duty as well as it does, it is largely because it is able to draw upon the information it derives from the English Board, to make use of its publications and researches, and indeed to humbly follow its footsteps. If forestry in Scotland is to be on its own, if England is to have a forestry of its own, and Ireland its own, forestry in Scotland will be a small thing compared with forestry in England. Cumberland, Westmorland, Wales, the south-west of England, and the eastern counties offer magnificent opportunities for planting, and although they are not on so large a scale as those of Scotland they are more compact, and great areas which you can plant completely are much more common. Therefore in the early stages there is a great deal to be said for afforestation in England rather than in Scotland, and I may add the experience of the war has shown that it is very much more convenient in the case of war to have timber in England than in Scotland. I am only mentioning those things to warn you that, if the countries are to be separated, you need not suppose Scotland will have a big forestry show and England a small one, because it will be the other way. We may be proud of it because it is our own, but it will be a small thing compared to England, and we shall be inferior as, I venture to think, in matters agricultural we have been inferior since we had the misfortune to divide ourselves from our more powerful neighbour. I am as keen as any Scotsman can be to keep our end up, and to have all our rights, but I do think this wish to stand alone in forestry is no more sensible than it would be to have our own Post Office."

The Chairman.—"An amendment was moved by Mr Menmuir and seconded, and it is quite in order. Mr Stebbing moved another amendment. I have considered that, and I am afraid I must rule it out of order, because it is not an amendment. It is a resolution, and not a resolution which the Society has been called to consider to-day. I do not wish to argue against it, but I must point out that when Mr Stebbing talks of a projected forestry scheme, no one knows what it is. It may be known to some individuals, but at any rate it is not known publicly. I am afraid I shall have to go now, and I must apologise very much for having to leave."

Mr Massie then took the chair.

Mr Stebbing.—"I would modify my amendment by simply saying matters should be left as they are instead of passing the resolution which is before the meeting."

The Chairman.—"Then you move the previous question, a direct negative."

Mr A. D. Richardson.—"Colonel Stirling and Colonel Balfour spoke of the French service. In the United States of America, where the woodland area is, I think, twice the area of the French one, the whole thing is administered by a Central Authority. The American service was, up to the year 1905, worked in connection with the Department of Agriculture, but it was found that it was so difficult to carry on forestry in conjunction with agriculture that the whole thing was divorced from it, and now forestry is entirely administered by a Central Authority, and it is only in those states where the bulk of the land is agricultural, that forestry education is carried on along with agricultural education. In the main forestry states, the educational part is divorced entirely from agriculture. That is now the only connection between agriculture and forestry in the United States. Each state has its own organisation, a Central Authority controlling the whole, and I understand that the scheme which the Reconstruction Committee have recommended is on all fours with that—to have a Central Authority for the United Kingdom, and each of the kingdoms to have its own administration. That is my reading of this report. But the most essential thing is that forestry should have a fund of its own. It should be administered by a Central Authority without any interference whatever from any other body. The difficulty just now is that nothing can be done because we have several bodies working at cross-purposes, and as for the Board of Agriculture for Scotland, I think the sooner we get away from it the better. Whitehall was never mentioned by this Society in connection with control until we went as a deputation to Mr Munro, when the question was put to the President—Would we rather have a Central Authority in Whitehall than an authority in Edinburgh, to which of course we said yes. That was a choice of one of two things, but we are not thereby committed to Whitehall. What we want is a Central Authority, and, as the chairman said, we might have that Central Authority anywhere. I do not think it matters where it is so long as we get it. I have pleasure in supporting

what Colonel Stirling and Colonel Balfour said about the French system, and I want to point out that the United States system is on all fours with it, and they have done that after experience of working forestry under the Agricultural Department and found it unsatisfactory."

Mr Andrew Hamilton, East Kilbride.—"I support Mr Stebbing in having things remain as they are, with improvements. It seems to me we cannot get any committee or board which will pay out of their own pocket for their mistakes, which Sir Hugh Shaw-Stewart says is very essential to get the maximum out of any estate. The new committee that we suggest setting up will still have the defect that it won't pay out of its own pocket. I do not see, with the developments that are going on and the energy that is being put into the forestry question, with public opinion changed as in a great many other ways during the war, that you are going to have the same difficulties now that you have had in the past; and in a time of war it is like changing horses while crossing the stream to make such recommendations, because that is all we do to the Government. I quite agree that there has not been enough done. I think we are all agreed on that, but, surely, if the necessary "ginger" is put into our proposals, the Agricultural Department will do a great deal more than it has ever done in the past. The Agricultural Department in England is far greater in its influence than the Agricultural Department in Scotland. That is to be expected because of the number of acres under cultivation, but the number of acres of possible afforestation area in Scotland, in relation to the total area, is very much greater in Scotland than in England, and therefore it is for the people of Scotland to show that we have forestry schemes that are capable of development, and to demand money at Whitehall or from Parliament. It seems to me far better to put our energy through the present Board of Agriculture than set up any new machinery which would only block the very object which we are all seeking to achieve. I second Mr Stebbing's amendment."

Colonel Malcolm of Poltalloch.—"It seems to me that everybody is very anxious that afforestation should be properly managed. I think it greatly depends on the men you get to manage it. If I am not rude in saying so, I can hardly imagine the Duke who has just left us seeking the position of manager of forestry under the Board of Agriculture in Scotland, but

I could quite imagine him taking the position of manager of forestry in the whole country, and therefore I am very strongly in support of the single Forest Authority. I hope that some day I shall see, or my successor will see, some of the leading men of the country holding this position."

Sir Hugh Shaw-Stewart.—"I feel Colonel Stirling's appeal very strongly that if possible we should be unanimous in this matter. The Society has gone on so harmoniously that it would be a pity if there were some who dissented from the finding of an important meeting like this. I have great sympathy with Mr Stebbing who looks at the matter from the practical point of view, and says—Do let us get trees in accordance with Scottish notions and Scottish climate, and so forth. My answer to him is—Is he quite sure if you leave things as they are that those trees will ever get in?—because the Scottish Board of Agriculture has not the money. They must go hat in hand to the Development Commissioners, and they have many other things which may be equally pressing on them. The money that Mr Stebbing would like to have to get these trees in must be forthcoming, and the thing can't be done without money. Will Mr Stebbing, and others who have shown that they would like an alteration or addition to this motion, listen to this proposed addendum and see if it meets their views—'the Central Authority to use the local authorities in England, Scotland, and Ireland for administrative purposes to meet local conditions'?"

The Chairman.—"Mr Menmuir, will you accept that?"

Mr Menmuir.—"By no means. Mr Richardson said the Society was not committed to Whitehall, but it is quite obvious that Whitehall would be the place for this Central Authority."

Colonel Stirling.—"Where is it now?—In the Secretary for Scotland's office."

Mr Menmuir.—"But it is not necessary that the Forestry Authority should be there."

Colonel Stirling.—"It is there now."

Mr Menmuir.—"Well, the sooner it is changed the better. Mr Richardson said it did not matter where the Central Authority was situated. I say that it is a very vital question for the Scottish people."

Mr Richardson.—"Whitehall is not mentioned in the report."

Mr Menmuir.—"I am quite aware of it."

The Chairman.—"Mr Stebbing, do you accept the addition?"

Mr Stebbing.—"I do not know that there is any precedent for this kind of thing in any other department. I do not see why we should think Ministers should make a departure in the case of forestry. It seems to me all this simply means delay, and what I feel is that when the war stops there are going to be much bigger things than forestry to be settled by the Cabinet, that forestry will be swamped, and we will have another fifteen years and nothing done."

Sir Hugh Shaw-Stewart.—"I only suggested this addendum to meet the opposition. Of course, if it is not going to be unanimous, I shall withdraw it."

Sir John Stirling-Maxwell.—"Mr Stebbing seems to be satisfied with things as they are, and looks forward to development on the present lines. Has it occurred to him how many strata of ignorance there are at the head of the present administration? Forestry policy is directed by the Development Commission which sits in Dean's Yard, not far from Whitehall. They have the money and they direct the policy. The Secretary for Scotland comes next. He does not pretend to be a trained forester; he is the head of the Board of Agriculture here. Below him comes Sir Robert Wright as Chairman of the Board. He is entirely ignorant of forestry, and he has never assisted us except in one flamboyant speech when it was suggested that the control of forestry should be removed from his department. Next under Sir Robert Wright is a fourth stratum of ignorance in the person of Dr Greig, who is the head of the forestry department. He is a delightful man, and we all respect him as an agriculturist, but he admits he knows nothing about forestry. Under all that you have the technical advisers. They have not always been consulted in the past, and they will not always be consulted in the future, as to the proposals to be made. I say without the least hesitation, if things remain as they are, forestry has not the slightest chance of being wisely done or being successful."

Mr C. G. Patterson, Castle Huntly.—The real purpose of the motion is to express what the Arboricultural Society considers is the ideal way in which forestry should be established in Scotland, and we are going to use, if I understand it, our best endeavours to get that adopted. While we are doing that the system which Mr Stebbing is supporting at present

will remain, and I do not suppose it really would be affected in any way. If we fail I suppose that system, bad as we all think it is, will go on, but surely unless Mr Stebbing and those supporting him are satisfied that the system which at present we are working under is the best, they ought to be able to support the motion which is before the meeting just now, because I cannot believe Mr Stebbing with all his knowledge does not think that if we could have such a proposal as this carried out, to get a central ministry for forestry, that that would not be a better way of managing forestry than has been in the past and is at present; and therefore I cannot see, with all deference to him, how if he supports the motion he would be really going against any trees being put in just now. Our other friend is practically a Home Ruler for Scotland. We all sometimes think we would like everything here. I am not so sure that when it is in London most of the money is there. We really get a larger share than the others. I am sure we are all as keen for Scotland as he is, but it would be a very good thing if we could all support this motion, which I understand expresses what we think would be the ideal way in which forestry should be carried out.

Mr Stebbing.—If the suggestion made is that this proposal is to be put before the meeting five years hence when the new methods which the Board have put into force, and the Secretary for Scotland is very anxious to back up and get money for, have been given a fair trial—if we give them five years—(cries of "No, no," and "Vote").

On a vote three supported Mr Menmuir's amendment; Mr Stebbing alone voted for his amendment, his seconder having left the meeting; and forty-four voted for the Resolution, which was accordingly adopted.

13. Observations in connection with Annual Increment of growing Crops of Timber.

By J. H. Milne-Home.

Some notes upon this subject have been published in previous numbers of the *Transactions* (vol. xxiv. p. 52, vol. xxvi. p. 160, and vol. xxvii. p. 34). The particulars there given relate only to a period of three years, and the conclusions drawn from the measurements which had then been made were admitted to be provisional and tentative. These observations have been carried on down to the present time, and certain fresh groups have been subjected to measurement, so that the results now obtained are of considerably greater value. The objects in view were twofold—

(1) To ascertain with as much accuracy as possible the percentage rate of increment for various ages and species of timber, and (2) to ascertain during what season the actual laying on of girth took place, and the proportion of growth made during each month of the growing season.

The method followed in making the observations has been referred to in previous articles, and need not be repeated further than to explain that the percentage rate of growth is calculated by the formula employed by continental foresters, viz., percentage rate of growth in any year $= \frac{400}{n \times d}$; "n" is the number of annual rings in the last inch of radial growth, and "d" the diameter under bark at 4 ft. 6 ins. from the ground. The value of "n" could at first only be estimated from one or two years previous growth, but as the yearly observations went on it was possible to arrive at this figure with increasing accuracy, and the percentages calculated for the more recent years will be correspondingly more accurate.

Considerations of space preclude details being given in tabular form of the whole of the results obtained for the period of eight growing seasons up to 1917, but the more essential figures are as stated below—

1. Plantation D.—*Japanese Larch.*

Year	Age from Planting	Estimated growing Stock	Number of Stems per acre	Average Diameter at 4′ 6″ high	Present per cent. rate of Growth	Mean annual Increment	Current annual Increment
	Years	Cub. ft.		Inches		Cub. ft.	Cub. ft.
1913	8	980	880	4·6	13·18	122	126
1914	9	1106	880	4·9	12·28	123	136
1915	10	1242	870	5·2	13·09	124	163
1916	11	1405	870	5·6	12·85	128	180
1917	12	1585	860	5·9	11·57	132	183

2. PLANTATION D.—*Spruce.*

1910	32	1320	450	6·8	6·95	41	91
1911	33	1411	450	7·0	6·58	43	93
1912	34	1504	450	7·2	6·35	44	95
1913	35	1599	440	7·5	6·16	46	98
1914	36	1697	440	7·7	5·94	47	101
1915	37	1798	440	7·9	5·80	49	104
1916	38	1902	440	8·1	5·77	50	109
1917	39	2011	440	8·4	5·62	51	113

3. PLANTATION B.—*Spruce.*

1912	36	2645	680	7·3	4·00	73	106
1913	37	2751	680	7·5	4·00	74	110
1914	38	2861	670	7·6	3·71	75	106
1915	39	2967	670	7·8	3·61	76	107
1916	40	3074	670	7·9	3·44	77	106
1917	41	3180	660	8·0	3·39	78	107

4. PLANTATION K.—*Spruce.*

1911	38	2700	700	8·9	3·29	71	89
1912	39	2789	700	9·0	3·12	71	87
1913	40	2876	690	9·2	3·06	72	88
1914	41	2964	690	9·3	2·93	72	87
1915	42	3051	680	9·4	2·72	73	83
1916	43	3134	680	9·5	2·75	73	86
1917	44	3220	670	*10·6	2·44	73	79

* Four trees only.

5. PLANTATION K.—*Scots Pine.*

1910	37	1200	710	6·2	4·24	32	51
1911	38	1251	710	6·3	4·75	33	59
1912	39	1310	700	6·4	4·41	34	58
1913	40	1368	700	6·6	4·23	34	58
1914	41	1426	690	6·7	4·12	35	59
1915	42	1485	690	6·8	4·14	35	61
1916	43	1546	680	7·0	4·30	36	66
1917	44	1612	670	7·2	4·40	36	71

6. PLANTATION I.—*Scots Pine.*

1910	40	1730	280	10·4	4·27	43	67
1911	41	1797	280	10·5	2·59	44	46
1912	42	1843	280	10·5	2·67	44	49
1913	43	1892	280	10·7	2·65	44	50
1914	44	1942	275	10·8	2·62	44	51
1915	45	1993	275	10·9	2·52	44	50
1916	46	2043	275	11·0	2·49	44	50
1917	47	2093	275	11·1	2·45	44	51

7. PLANTATION I.—*Spruce.*

1910	40	2800	280	11·5	4·16	70	116
1911	41	2916	280	11·7	3·54	71	103
1912	42	3019	280	11·8	3·75	72	113
1913	43	3132	280	12·0	3·53	73	110
1914	44	3242	280	12·2	3·23	74	105
1915	45	3347	280	12·4	3·22	74	108
1916	46	3455	275	12·5	3·03	75	105
1917	47	3560	275	12·7	2·92	76	104

The mean annual increment is obtained by dividing the estimated growing crop for any particular year by the number of years which have elapsed since planting. The current annual increment is obtained by applying the percentage rate of growth to the estimated growing crop of that year. No account has been taken of intermediate thinnings of which no records exist.

The Japanese larch have been placed first although the observations only cover five years, owing to the remarkable nature of the results obtained. The trees are growing on a bank at about 300 feet elevation with south-east aspect. It will be observed that the crop had become measurable within eight years from planting, and that the current annual increment for 1917 was 183 cubic feet per acre, without any sign of diminution. The percentage rate of growth is also very high. It is scarcely to be expected that growth can continue very long at this rate, and in view of the widely held opinion that Japanese larch ceases to make satisfactory growth at a comparatively early age, it will be interesting to see how far this view is supported by actual observation. It is doubtful whether any other species, unless Douglas fir, can show a correspondingly rapid rate of growth.

The spruce in Plantation D are growing on good soil but the crop is rather thin, and has been dominated to some extent by scattered hardwood trees. These conditions are reflected in the comparatively poor mean annual increment. It is only in recent years that the crop has begun to escape from these conditions, and the current annual increment has now reached the fairly good figure of 113 cubic feet per acre per annum. In this as in other cases it will be observed that a falling percentage rate of growth does not necessarily mean a falling off in the total increment per acre, for the reason that the percentage is each year calculated upon a larger total quantity.

The spruce in Plantation B represents a different class of soil and situation, the crop being grown upon what was formerly hill land not previously under trees. The results are on the whole favourable, the current annual increment remaining still fairly constant at over 100 cubic feet per acre per annum.

The spruce in Plantation K also represents a crop growing on what was formerly hill pasture. The soil in this case is somewhat poorer, and the current annual increment shows signs

of falling to about the level of the mean annual increment. When this point is reached it is usually time to cut the crop, as no advantage can be served, unless timber of specially high quality is being aimed at, in allowing the current to fall below the mean annual increment.

The Scots pine in the same plantation shows some rather interesting results. The very low mean annual increment (32 feet to 36 feet) indicates the struggle which the crop probably had in its early stages to get established at all, and it was very likely 20 or 25 years before the crop was even measurable. Between the years 1910 and 1914 it certainly appeared that this crop would be better cut for pit-wood, and a more suitable species planted in its stead. The sudden increased growth in the last few years has, however, contradicted that conclusion, and the explanation is no doubt to be found in the fact that the canopy is now fairly good, that the surface conditions of the soil have become better, and that in all probability the roots have opened up and penetrated the soil to greater effect. A sudden change in the growth of a crop, either for the better or the worse, would be difficult to detect or estimate by mere inspection unless supported by actual measurement.

The Scots pine in Plantation I illustrates clearly the unsuitability of most soils in the district for the growth of this species. The soil and situation are good, but both mean and current annual increment are disappointing. This is especially so if the figures are compared with those which immediately follow for the spruce growing in the same plantation. It may be emphasised that, with the exception of the Japanese larch, none of the crops under observation have been grown in the past under the best possible conditions. The increment results now obtained do not therefore show the utmost of which the soil and species are capable under the best conditions of planting and subsequent management. In spite of such drawbacks it will be observed that in three different cases the current annual increment for spruce is over 100 cubic feet per acre, with a mean annual increment of between 70 and 80 feet. At a moderate estimate it should be possible to increase these results by 20 per cent., which would represent a yield very substantially beyond what is looked for at the present time in continental forests.

The growth made during the summer months has proved variable in different seasons. To analyse the figures in detail for each year would occupy too much space. The following are the average results—

Plantation	Species	Number of years observed	Percentage of whole season's growth made during the months of					Total
			May	June	July	Aug.	Sept.	
D	Japanese Larch	5	20	37	23	18	2	100
D	Spruce	8	20	31	22	20	7	100
B	Spruce	6	15	30	24	29	2	100
K	Spruce	7	14	35	31	15	5	100
K	Scots Pine	8	27	26	25	18	4	100
I	Scots Pine	8	17	40	17	22	4	100
I	Spruce	8	20	32	23	19	6	100
Average for all Species			19	33	24	20	4	100

The general conclusions which may be drawn from these figures appear to be that in the average season timber increment commences about the middle of May, and attains its maximum in June, during which month one-third of the whole increment is laid on. There is a gradual falling off in growth during July and August, when in many cases increase in girth ceases. In certain trees, especially on better soils, a small growth is made in September. It has been observed that a cold backward season with an absence of sun may postpone any timber increment until June, but rainfall in the early part of the season is not so important, no doubt because there is rarely any lack of soil moisture at that period. Prolonged dry weather in the latter half of June or in July has, however, a very marked effect on both spruce and Japanese larch, although when sufficient rain does fall the loss of growth is usually made up. It is clear, however, that for Japanese larch the summer rainfall can hardly be excessive, provided there is a reasonable amount of warmth. In one or two seasons a slight growth has been noticeable in the Japanese larch in April, but it has not been thought worth while recording this separately, and it is consequently included in May.

14. Taxation of Woodlands.

By THE PRESIDENT.

It is now generally recognised that the incidence and amount of taxation and other public burdens on woodlands must very largely determine whether any extensive additional areas will be planted by private enterprise, or whether even the existing areas felled during the war will be replanted. Although it is known that the burdens on woodlands are heavy, it is seldom realised how onerous they are, or that the system of taxation as applied to woodlands is unfair, and presses more severely upon that form of property than upon any other.

Appended are two statements of taxes, rates, and other burdens on woodlands calculated for the present financial year, viz. 1918-19. The first is for the whole of the woodlands, comprising an area of over 4000 acres, on my estates in Eskdale and Liddesdale, where the rates are comparatively low. The second statement is for woodlands belonging to me in the parish of Dalkeith, where the rates are higher and the annual value in the Valuation Roll is 10s. per acre—

1. *Eskdale and Liddesdale Estates* (*Counties of Dumfries and Roxburgh*).

Area of woodlands, 4120·3 acres.

Valuation, £569, 15s., equal to £0, 2s. 9·2d. per acre per annum.

					Rate per £ of Ann. Value.
County Rates, as owner			£28 5 0		
,, as occupier			24 2 7		
			£52 7 7	£0 1 10·1	
Parish Rates, as owner	£31 14 4				
,, as occupier	37 17 10				
			69 12 2	0 2 5·3	
Heritor's Assessment			0 12 3	0 0 0·2	
Land Tax			5 1 6	0 0 2·1	
Ministers' Stipends			86 3 6	0 3 0·3	
Total burdens other than Income Tax and Super-tax			£213 17 0	£0 7 6	
Income Tax for the year 1918-19 being at the rate of 6s. per £ and Super-tax at 4s. 6d. per £, the following will be the sums chargeable upon these woodlands :—					
Income Tax, Schedule A, on		£569 15 0			
Less one-eighth	£71 4 5				
Allowance for Owner's Rates, Heritor's Assessment and Land Tax at £0, 2s. 3·6d.	65 13 1				
Ministers' Stipends	86 3 6				
		223 1 0			
Net sum chargeable		£346 14 0			
Carry forward			£213 17 0	£0 7 6	

Brought forward . .					£213	17	0	£0	7	6
£346, 14s. at 6s. per £ . . .		£104	0	2						
Schedule B, on £569, 15s. at 6s. per £		170	18	6						
					274	18	8	0	9	7·8
Super-tax on Schedule A, net assessable value of £346, 14s. at 4s. 6d. per £		£78	0	2						
On Schedule B, £569, 15s. at 4s. 6d. per £		128	3	10						
					206	4	0	0	7	2·9
					£694	19	8	£1	4	4·7

The rate *per acre* for all rates and taxes is 3s. 4½d.

2. *Dalkeith Estate* (*Parish of Dalkeith and County of Midlothian*).

Area of woodlands, 396·1 acres.
Valuation, £200, or say 10s. per acre per annum.

							Rate per £ of Ann. Value.
County Rates, as owner				£13	2	6	
,, as occupier				10	14	7	
				£23	17	1	£0 2 4·6
Parish Rates, as owner . .	£14	3	4				
,, as occupier . . .	14	11	8				
				28	15	0	0 2 10·5
Heritor's Assessment				1	5	0	0 0 1·5
Land Tax				1	17	6	0 0 2·3
Ministers' Stipends				57	10	0	0 5 9
Total burdens other than Income Tax and Super-tax				£113	4	7	£0 11 3·9
Income Tax for the year 1918-19 being at the rate of 6s. per £ and Super-tax at 4s. 6d. per £, the following will be the sums chargeable upon these woodlands:—							
Income Tax, Schedule A, on . .	£200	0	0				
Less one-eighth .	£25	0	0				
Allowance for Owner's Rates, Heritor's Assessment and Land Tax at 3s. . .	30	0	0				
Ministers' Stipends .	57	10	0				
		112	10	0			
Net sum chargeable . . .		£87	10	0			
£87, 10s. at 6s. per £ . . .		£26	5	0			
Schedule B, £200 at 6s. per £ .		60	0	0			
				86	5	0	0 8 7·5
Super-tax on Schedule A, net assessable value, £87, 10s. at 4s. 6d. per £	£19	13	9				
On Schedule B, £200 at 4s. 6d. per £	45	0	0				
				64	13	9	0 6 5·6
				£264	3	4	£1 6 5

The rate *per acre* for all rates and taxes is 13s. 2⅓d.

The foregoing statements show the amount of the taxation for the year 1918-19 when the woodlands are assessed for income tax under Schedule B. In addition, death duties have to be paid at the rate of 21 per cent. on the net value of any timber sold.

It should also be remembered that in the case of agricultural lands the occupier has the option in any year of being assessed either under Schedule B or Schedule D, but that in the case of woodlands if the occupier elects to be assessed under Schedule D, he is not allowed to revert to Schedule B.

It is often said that an owner of woodlands dissatisfied with taxation under Schedule B, should avail himself of the option to claim assessment under Schedule D. I maintain, however, that under Schedule D woodlands are taxed not only unfairly but to a greater extent than any other form of property. Anyone who is liable for death duties on the highest scale has to pay 21 per cent. on the net value of timber sold, and he also has to pay under Schedule D 10s. 6d. per £ (52½ per cent.) for income tax and super-tax.

It is important to note that this taxation is not on an annual crop, but on the accumulated value of trees which were planted from say 50 to 150 years ago. If woodlands in this country were in regular gradations of ages, as in continental forests where scientific forestry has been practised for centuries, there would be a fairly even and assured annual income, but there are very few, if any, estates in this country where such conditions exist. Moreover, this state of affairs has been accentuated by the exceptionally heavy fellings of both mature and immature woods which have been made during the war, in response to the national requirements and at the express request of the Government.

I believe there is no other form of property of which the value when realised is treated as *capital* for death duties and as *income* for income tax, etc., purposes, and I maintain that such a method of taxation is absolutely unjust.

For instance, suppose anyone is left £100,000 in stocks, and also timber to the value of £100,000; in a case where death duties are payable on the highest scale, the amount of duty on the stocks would be £21,000, and if the stocks are sold there is nothing more to pay; whereas in the case of the timber, if it is sold, there is not only £21,000 of death duties to pay, but also

£52,500 of income tax and super-tax under Schedule D, making a total taxation of £73,500 in the case of the timber as against £21,000 in the case of the stocks.

In the final report of the Forestry Sub-Committee of the Reconstruction Committee, Appendix 7, page 100, the estimate of initial outlay for planting is £5, 10s. per acre, and the estimate of the total annual outgoings 6s. per acre per annum.

£5, 10s. at compound interest for 70 years at 5 per cent. is £166 7 0

£5, 10s. at compound interest for 70 years at 2½ per cent. is £30 18 0

6s. per annum works out at £176, 11s. and £55, 9s. respectively. Therefore the total cost for 70 years would be—

At 5 per cent. compound interest . . . £342 18 0

At 2½ per cent. „ „ . . . £86 7 0

On page 101 the Forestry Sub-Committee estimate the returns from larch under a rotation of 70 years at £232, and from Sitka spruce for the same period at £215. Their estimate for Douglas fir is rather higher, but Douglas will only grow under very favourable conditions, so I leave it out of account. In the case of spruce and Scots pine, for which the report estimates a rotation of 80 years with final yields of £185, 12s. 6d. and £168, 10s. 10d. respectively, the results would be even more unfortunate.

The Sub-Committee estimate that larch would realise .	£232
From which falls to be deducted death duties at 21 per cent., Schedule D income tax and super-tax at 52½ per cent. (10s. 6d. in £)	170
Leaving a return of	£62
The Sub-Committee estimate that Sitka spruce would realise	£215
From which falls to be made the same deductions of 21 per cent. and 52½ per cent as above . .	158
Leaving a return of	£57

Thus even at 2½ per cent. compound interest there is a loss of £24, 7s. on the crop of larch, and of £29, 7s. on the Sitka spruce. At 5 per cent. compound interest the loss would be £280, 18s. and £285, 18s. respectively. In the case of timber which is mature at the present time, there will have been paid during the past seventy years income tax under Schedules A and B, and

also rates and other public burdens on an assumed annual rental which has not in fact been received, as would have been the case had the land been in agricultural occupation.

It must be recognised that in the case of new plantations for which the owner has the option of assessment under Schedule D as a "separate estate," the payment of income tax is only exacted in any given year in which there is a profit. The rent which would have been received from the land if in agricultural occupation, is, however, lost whatever the method of assessment for income tax, and, in addition, the owner's and occupier's rates have to be paid annually.

Although the double assessment under Schedule B as first proposed under the Finance Bill of 1918 has now been dropped as regards woodlands, this does not alter the fact that the whole system of the taxation of woodlands as compared with other forms of property is unjust, and should, I maintain, be reconsidered and placed upon a basis which is fair and suitable to the industry.

15. On Nurse Trees in Young Plantations.

By Colonel STIRLING of Keir.

The value of shelter to young plantations has long been recognised by practical foresters.

Shelter may be given—

1. In the case of old woods, by leaving a portion of the previous crop.

2. In the case of new plantations, (*a*) by making use of any existing growth of birch, alder, hazel, etc.; (*b*) by planting certain species to act as nurses, either a few years in advance of the main crop or at the same time with it.

The theory of regeneration under shelter-woods is well explained in the modern manuals of silviculture. The practice of planting nurse trees is more general in this country than abroad, and although the older writers on forestry in Great Britain laid stress upon it, perhaps it has not received from recent writers all the attention which it deserves. Like most useful practices, the planting of nurse trees can be carried to excess. The mistakes of planting too many nurse trees, and of

delaying their removal until too late, have given to us in this country some of the worst plantations in the world.

A common result of these mistakes is the kind of plantation which a distinguished French forester has called a salad—a mixture of incongruous species, broad-leaved and coniferous, struggling desperately for life, and succeeding only in injuring one another. There is nothing to be done with such a plantation, but to cut it down and begin over again, unless, as may often happen, our intentions are anticipated by a gale which blows the whole thing flat. It seems that the accepted practice of some forty to sixty years ago was to plant altogether too many nurse trees in mixed plantations, and too many different kinds of trees.

Brown, a forester whose work contains much of permanent value, recommended the planting of larch and Scots pine as nurses to hardwood plantations, in the proportion of twelve larch and nine Scots pine to every three hardwoods.[1] In the type of plantation recommended by him every fourth row consists of hardwoods (oak, ash, elm, and sycamore) alternating with Scots pine; the other three rows are larch and pine, two rows of larch to one of pine. A great deal of care and attention must have been required to give a plantation of this kind a chance of realising the planter's intention of a crop of mixed hardwoods; the number of hardwoods is relatively so small that the loss of a few in the early years would be very serious; beating up with small plants would be useless, and even if the expense of using large plants were not a serious objection, there would be little hope of their establishing themselves in such a heavy crop of fast-growing conifers. No doubt the large number of larch planted was intended to give early thinnings of some value; but when there are as many as four larch to each hardwood, the larch will rapidly occupy the available growing space, and many of them will have to be cut out before they are of any value, if the hardwoods are to be saved. Indeed, in plantations made according to this prescription, the result most likely to be attained is a mixture of larch and pine with a few hardwoods, one that is common enough in our middle-aged plantations, and that is open to the grave silvicultural objection that it consists entirely of light-demanding trees.

Nothing could illustrate better the advance of scientific

[1] *The Forester*, by James Brown, 3rd edition, Edinburgh, 1861, page 443.

silviculture in Great Britain within the last three decades than the fact that up to about 1895[1] Brown's *Forester* was the standard authority on the subject; a place which it still deserves in every respect except that of silviculture. It would be hardly possible to improve on much of the advice given by Brown on the selection of ground, draining, fencing, formation of nurseries, and planting. It is only on the silvicultural side that his advice needs to be qualified in the light of scientific research on the Continent and in this country.

The following notes refer to nurse trees in young plantations of hardwoods, chiefly beech and oak. They are based on the experience of annual plantings for the last eleven years, a period which covers the whole existence of the bulk of the nurse trees.

The chief points of a good nurse tree are—1. Hardiness against spring frost. 2. Rapidity of growth when young. 3. Light foliage and upright habit. 4. Ability to stand pruning. 5. Value as early thinnings.

The trees employed in this case have been—1. European larch. 2. Japanese larch. Of these, the European larch has proved superior in hardiness against spring frost, in lightness of foliage, and habit of growth. Both larches have grown rapidly; the European larch has made the more rapid growth in height, and the Japanese has given the larger bulk of small pit-wood at the age of nine to eleven years. The Japanese larch has the disadvantage of throwing out strong side branches, but it stands pruning well.

The method of planting is as follows:—The planting distance is 3 feet; of 4840 plants to the acre, approximately 2500 are beech, 2 year-1 year, 1500 oak, 1 year-1 year, and 800 larch, 2 year-1 year. Every third row consists of larch and beech alternately; the other rows consist of beech and oak alternately, so that the larch nurses stand 6 feet apart in the rows, and the rows of larch and beech are 9 feet apart.

For the first three or four years after planting, the nurse trees have very little influence on the growth of the crop. There is ample space for all, and if after the second year the larch begin to take the lead it is only as isolated individuals. From the fourth or fifth year the larch takes much more than

[1] Dr Nisbet's enlarged and modified edition of Brown's *Forester* was published in 1894.

its share of the growing space. The lines of larch become the conspicuous feature of the young plantation, and give shelter to the adjoining lines of oak and beech. It may be said that as soon as the nurse trees begin to do good to some of the young oaks by their shelter, they also begin to injure others by their side shade. From the fifth year until the last of the larch are cut out, the plantation requires close attention and care, directed to obtaining the maximum benefit from shelter, and the minimum injury from side shade. The whole tending of the wood at this stage has for its object the development of a large number of healthy young oaks, from which the most valuable part of the future crop will be selected. The beech needs little attention—the plants which stand alternate with larch in every third line may be in danger of suppression, but they are easily protected by shortening back the branches of the larch.

To describe the early tending of the plantation in more detail: up to the fifth year after planting, little attention is necessary, except where strong-growing weeds have to be kept down. About the fifth year, self-sown birch may begin to give trouble, and if it is in any considerable quantity it can be cut for sale to steel works at a price which will more than cover the expense. At the same time, any badly grown larch are cut out and burnt, and strong-growing side branches are pruned back where interfering with the young oaks.

In the sixth year some more pruning of side branches may be necessary. In the seventh to eighth year it often becomes necessary to reduce the number of larch where the oaks are suffering from their shade; sometimes a very severe pruning is all that is needed. In the ninth year at least half of the remaining larch are removed, giving some 350 pit-wood poles per acre. The remainder of the larch are cut out in the tenth and eleventh years, giving another 300 to 350 poles per acre of rather larger size. At the present prices the return from these early thinnings is not negligible; and although a much larger return could be obtained by allowing some of the larch to stand for three or four years longer, this gain would be at the expense of the future crop of oak and beech, which must suffer if any appreciable number of larch are retained in the crop after the eleventh year. As a rule, any larch remaining after the eleventh year will be younger trees which have

been used to fill up blanks in the first few years after planting.[1]

A certain amount of ground in the plantations described is planted with oak and beech only, and the growth of the oaks under these conditions is very much less than where they have been sheltered and stimulated by the more rapid growth of the larch.

The following measurements of the height of oaks, growing in mixture with beech, are taken from plantations ten years old, grown as nearly as possible in similar conditions—in one case with, and in the other without, larch nurses. In each case, twenty oaks have been taken, as they grew, without selection:—

A—With Larch Nurses.				*B—Without Larch Nurses.*			
	ft. ins.		ft. ins.		ft. ins.		ft. ins.
(1)	8 0	(11)	10 0	(1)	6 2	(11)	8 6
(2)	8 3	(12)	7 2	(2)	5 3	(12)	5 9
(3)	10 3	(13)	9 11	(3)	4 11	(13)	6 10
(4)	8 3	(14)	7 7	(4)	6 11	(14)	6 9
(5)	7 8	(15)	9 0	(5)	4 10	(15)	5 6
(6)	7 6	(16)	9 2	(6)	6 9	(16)	7 9
(7)	7 11	(17)	10 6	(7)	5 6	(17)	7 11
(8)	8 11	(18)	10 1	(8)	8 0	(18)	6 10
(9)	9 8	(19)	8 8	(9)	6 7	(19)	7 6
(10)	8 5	(20)	10 0	(10)	8 7	(20)	9 4
Average, 8 ft. 11¾ ins.				Average, 6 ft. 9½ ins.			

The trees measured are growing in adjoining plantations. In order to get as nearly as possible similar conditions, a strip about 15 feet wide was taken, in each case on the southern edge of the plantation. It is possible that in both cases some of the

[1] The following measurements of pit-wood are from recent fellings. It is regretted that accurate measurements of the whole of the pit-wood removed from one acre from the ninth to the eleventh year are not available.

Thinnings of European larch nurses planted in spring 1911 on land which was ploughed in 1910 and kept hoed in 1911-12. Individual trees up to a maximum of 26 feet in height, showing growth of 4 ft. 3 ins. and 4 feet in 1916 and 1917. Average length of pit-wood down to 3 ins. diameter at small end, 9 ft. 8 ins. Final return from Japanese larch nurses planted as 2-year seedlings on old grass in autumn 1907, felled in winter 1917:—An area of one acre gave 3099 lineal feet of short pit-props down to 3 ins. diameter at small end, of this 848 feet were 4 ft. by 4 ins., 1672 feet, 4 ft. by 3 ins., and 579 feet, 3 ft. by 3 ins. Number of trees unfortunately not counted, probably 360 is a fair estimate, giving an average length of 8 ft. 7 ins. of pit-wood per tree. The Japanese larch was straighter than the European larch rapidly-grown on hoed land.

smaller trees were planted to replace failures. In the best part of Plantation A many of the oaks are 12 to 15 feet in height.

It is possible that some other kind of tree, for example, birch, might possess all the other good qualities of larch as a nurse, but hitherto larch stands alone in the value of the early thinnings. Between European and Japanese larch, I am inclined to prefer European, on account of its less heavy shade and less spreading habit. Possibly some other species of the same family may give even better results than the European larch.

The Kurile larch seems to be of upright habit and of rapid growth when young—my experiments with it as a nurse are too recent to give any guide to expectation.

One feature is noticeable in all the plantations described, the very trifling extent of damage done by the larch canker and aphis. Disease is very prevalent in the locality, and plantations with a large proportion of larch are as a rule much affected. With 800 larch to the acre in a much larger number of oak and beech, the canker does not seem to be able to make any headway against the vigorous growth of the young trees up to the age of ten or eleven years. It is to be found on dead branches, but seldom on the stems, and this in spite of fairly severe pruning of the side branches.

It remains to be said that the plantations described were made by the advice of the late Professor Fisher, who in 1907 drew up a working-plan for the woods at Keir. His recommendations have been thoroughly justified by the result, both in the good growth of the oak and beech, and in the considerable return from the early thinnings of larch. The war has had the effect of making a good market for small pit-props, but even if there were no market in this direction much useful fencing material would be obtained from the larch. The plantations are intended primarily for the production of first-class oak timber. The soil is, as a rule, much more suitable for the growth of hardwoods than of conifers. Experience has shown that European larch is very subject to disease when grown as a crop in this locality, and when it is grown in mixture with other conifers it often shows signs of heart-rot at about twenty-five years old, perhaps on account of its too rapid growth in youth. Admittedly a heavier crop could be obtained on a shorter rotation by growing conifers instead of hardwoods, but experience with these is not encouraging, except perhaps on a very short

rotation for the production of pit-wood. Spruce grows very rapidly, but it is not at all wind-firm; after all it is essentially a tree of the mountains, and its shallow root-system, admirably adapted for anchoring the tree in stony soil, is unsuitable for the local conditions. Douglas fir is very apt to be blown down between the thirtieth and fortieth year, perhaps on account of the inability of its roots to penetrate the heavy subsoil which suits the oak well. Sitka spruce seems to be more wind-firm than Douglas fir, but the average rainfall is probably less than that required for its best development.

And perhaps where hardwoods can be grown to perfection, it is not necessary to look elsewhere for a permanent crop. At the same time, the slow process of establishing the long rotation necessary for oak affords ample opportunity of experimenting with short rotations of conifers on areas which cannot be brought under hardwoods during the first period of the working-plan.

An incidental advantage of Professor Fisher's system of planting is that it is flexible; ash or sycamore can be substituted for oak in certain places. Few plantations of any extent have uniform conditions as to depth of soil and amount of soil moisture. If in some places where oak has been planted it is found to be backward in growth about the eighth or ninth year, it is still possible to exercise control over the nature of the crop in these patches, which, in the plantations described, will never be large. Even if the oak should be entirely suppressed, as it may be where the conditions do not suit it, there will be plenty of beech to make a patch of pure beech, or in places where the larch is growing really well, of beech with a few larch. But perhaps the most common result will be a patch with a few oaks and a larger proportion of beech than usual or generally desirable.

These plantations will provide many interesting problems for the skill of the forester, and perhaps none of them is more interesting and more important than the management of the nurse trees.

16. A Famous Frenchman and his Garden: M. Gaston Allard of Angers.[1]

By F. R. S. Balfour.

Early in January the famous arboriculturist of Angers—M. Allard—died at his home, La Maulévrie, aged nearly 80 years. The writer is almost certainly the last Englishman to see him. I went to Angers for the first time last autumn and little expected to see the founder of the famous garden, as I knew that for several years M. Allard had been in a very feeble and precarious state of health. Professor Sargent, who, of course, was already well acquainted with the Allard collection of trees and shrubs, had asked me to accompany him to France and to Angers in August 1914, but the war broke out and put an end to the project. In the early part of October 1918, while visiting M. Allard's neighbour, the Marquis de Charnacé, I was enabled to carry out this plan.

I found M. Allard sitting with a friend on a seat in the garden on the sunny side of his pleasant country house, and after telling him I had come from Paris to see his famous trees, he insisted on showing me himself the plants he knew and loved so well. He was nearly blind and exceedingly frail and could not speak above a whisper, but notwithstanding his weakness he took me to the specimens I especially wished to see. *Populus euphratica* (the "willow-tree" of the Psalms), one of the few in cultivation, he pointed out as not likely to outlive himself long. A new red-flowered jasmine and *Idesia polycarpa* in splendid fruit were the next treasures that he wished me to appreciate; in the case of the latter he had grafted the male and female plants on the same stock. Of his oaks he was especially proud—as well he might be, the collection being a very complete one, especially of Eastern American species. He showed me a *Quercus libani* bearing its large acorns profusely, and insisted on my filling my pockets with them as well as with the ripe fruits of a hybrid *Torreya nucifera* crossed by himself with *Torreya myristica*. It was interesting and very touching to see how his vigour seemed to return the farther he went among his beloved trees.

M. Allard after leaving school entered as a student the

[1] Reproduced from the *Kew Bulletin*, Nos. 2 and 3, 1918, by kind permission of the Controller of H.M. Stationery Office.

École d'Agriculture de Grand Jouan where he learned his botany, which led him some years later to establish his Arboretum de la Maulévrie.

He travelled extensively for three years in Algeria, Tunis, and Morocco, when he made the flora of those countries his especial study at a time when travel there was a matter of much difficulty and some danger.

He settled at Angers in 1862, and a few years later began to form his Arboretum, which to-day contains a full collection of trees from North America, China, Japan, and the Mediterranean littoral.

He has bequeathed this collection of half a century to the Pasteur Institute, and it is expected that his house will be used by the Institute as a laboratory of vegetable biology. Doubtless he felt that this was a more certain way to preserve it to posterity than to leave it to the Angers Municipality, which is an elective body.

M. Allard's garden, though well known to British tree lovers, is not, I think, so well known in France. Few of his fellow-townsmen were aware of the great fame of his collection. Let us hope that its new owners will bestow the same skill and thought upon its care and enrichment as M. Allard himself would have wished for it.

17. Damage to Vegetation by Smoke and Fumes.

By Alexander Lauder, D.Sc.,
Hon. Consulting Chemist to the Society.

The comprehensive report of the "Selby Smelter Commission" (published by the U.S. Dept. of the Interior, Bureau of Mines, Bulletin 98, 1915) is the most important contribution to this subject which has been made in recent years.

The report is well worthy of serious study, not merely on account of the exhaustive nature of the enquiries carried out and the value of the results obtained, but because of the great advance which has been made by the appointment of this Commission in the method of settling disputes involving scientific evidence and investigation.

The early history of the dispute which led to the appointment

of the Commission followed familiar lines. The Selby Smelting & Lead Co. set up large works in Solano County, in the State of California, for the smelting of ores. After a time the inhabitants of the surrounding districts alleged that the works were giving off fumes and smoke detrimental to vegetation and to the health of the people.

In 1908 the "people of the State of California" brought an action against the Selby Smelting Co., which was tried before a judge in the usual manner. Both sides brought forward expert evidence to support their claims and to disprove the statements made by their opponents. As a result, judgment was given against the Smelting Company, who were required by the Court to carry on their operations in such a manner as not to cause damage to the vegetation or annoyance to the inhabitants of the district. The Smelting Company twice appealed against this decision, but the judgment of the first Court was confirmed in the Supreme Court of the State in 1912.

During the progress of these legal proceedings the Smelting Company made considerable alterations at their works and in their methods, with the object of complying with the above decree and abating the nuisance which undoubtedly appears to have existed.

In 1913, however, trouble broke out afresh, the inhabitants of the country near the works alleging that a nuisance still existed, and that the terms of the interdict were not being observed. Both sides were again faced with the prospect of further costly legal proceedings, with no guarantee that, at the end, the case would be finally or equitably settled, or that either side would be satisfied with the result.

As the result of consultation between the parties, it was agreed to appeal to the Court to appoint a Scientific Commission to investigate the whole question and to carry out the necessary experimental work to enable an equitable judgment to be given. In appointing the Commission the Court clearly recognised that much experimental work would be necessary, inasmuch as sufficient data did not exist to enable the question to be settled. The Court therefore appointed a Commission, consisting of Mr J. A. Holmes, Director of the U.S. Bureau of Mines (chairman), Mr Edward C. Franklin, Professor of Organic Chemistry in the Stanford University, and Mr Ralph A. Gould, Chemical Engineer, San Francisco, secretary of the

Commission and in immediate charge of the investigations, to carry out the necessary experimental work and to report. The Commission had power to call and to examine witnesses, and to cause such alterations as they thought necessary to be carried out by the Smelting Company, either in the plant or methods employed. The costs of the investigations were to be shared equally by both parties, and the findings of the Commission were to be accepted as final.

The carrying out of such a series of investigations as was desired by the Commission required the services of a considerable number of trained scientific and technical men. They arranged that, as far as possible, each investigation should be carried out by the co-operation of at least two specialists in that particular branch of work. Without exception, all the men in charge of the work have been thoroughly trained in science and technology, have had, in addition, the necessary experience, and in no case had any partisan interest in the findings.

As the investigation was a semi-official one, the assistance of various departments of the University of California was readily obtained, and in particular that of the staffs of the College of Agriculture and of the Department of Physiology. The staff of the U.S. Bureau of Mines was also placed at the disposal of the Commission, and much of the work of the Commission's staff was carried out in the Bureau of Mines laboratories in San Francisco.

As it was highly desirable that the inquiry should be completed in as short a time as possible, a large staff was appointed to deal with the numerous investigations which were necessary. This staff numbered 29 in all, and included 10 chemists, 2 plant pathologists, an entomologist, 2 soil experts, a protozoologist and bacteriologist, and 9 assistants to the different departments. From this it will be seen that the Commission was fully staffed and equipped for its work in a manner quite unheard of in this country.

The Commission first of all reviewed the evidence which had been led in the legal inquiries already held. They found that much of this evidence would not stand the test of scientific scrutiny, and finally decided that it should all be rejected. The conditions at the smelter were first investigated. The smoke from the Selby smelter was composed of three different

classes of material—dust, fume, and gases. The deleterious substances present were sulphur dioxide, sulphur trioxide, compounds of lead and arsenic, and flue dust.

As the result of methods for purifying the smoke before allowing it to escape into the air, and also of alterations in the metallurgical methods employed in the works, the escape of visible smoke or fumes into the air was ultimately entirely prevented. These improvements had been carried out partly by the Company themselves and partly at the request of the Commission. The inquiry was therefore narrowed down to determining the amount of sulphur dioxide in the air in the neighbourhood of the works under varying atmospheric conditions, and to discovering how much of this gas must be present in the air in order to cause definite damage to vegetation.

First of all, the factors causing the distribution of the sulphur dioxide in the atmosphere had to be studied. This meant a careful investigation of the directions of the wind throughout the year, and measurements of the time the wind was blowing in each particular direction.

Next, methods had to be invented for the rapid determination of the sulphur dioxide in the air; certain fixed stations for this purpose were set up and a large number of analyses made. It was sometimes essential to make simultaneous determinations at two places at considerable distances apart to test the effect of the wind on the distribution of the sulphur dioxide. For this purpose a moveable laboratory was fitted up on a motor car, much after the plan of the motor laboratories and operating cars used in the war. This enabled determinations of the amount of sulphur dioxide in the air to be made at many places, in addition to the analyses made at the fixed stations. During the six months of active field work no less than 4862 analyses were made, 3629 at the fixed stations, and 1233 at a great many points by means of the motor laboratory. In this way a large amount of valuable data was obtained regarding not only the amount of contamination in the zone affected by the smoke, but also as to the amount of sulphur dioxide usually present in the air where there is no special industrial pollution.

During the time the above work was in progress, other members of the staff carried out a very complete series of observations on the effects of different amounts of sulphur

dioxide on growing vegetation. As much of the country in the smoke zone was devoted to agriculture, the experiments naturally dealt largely with the ordinary grain crops.

Many serious experimental difficulties had to be overcome in the course of these investigations, and much ingenuity and resource were shown by the staff in devising suitable methods and apparatus. These experimental details are hardly suitable for a paper of this kind, but it may be mentioned that since sulphur dioxide is rapidly absorbed by vegetation, by soil, and by moisture, the fumigation of a growing crop with air containing a definite and constant percentage of sulphur dioxide is no easy matter. As a farm crop is only exposed to the fumes during the growing season, and as the number of experiments was large, the results obtained may be taken as reliable.

It is different, however, in the case of woods where the trees are exposed to contamination year after year. In this case an amount of sulphur dioxide which might not cause any great effect in a single season might easily have a deleterious effect in the course of a number of years.

The humidity of the atmosphere was found to have a very important effect, as was to be expected; in presence of moisture the damage caused by the same amount of sulphur dioxide or trioxide was much greater than when the air was dry. It was also found that the damage was greater in sunshine than in the shade, but this was found to be a much less important factor than the humidity.

The report is illustrated with an excellent series of coloured plates, showing the effects of various amounts of sulphur dioxide on the leaves.

The investigations carried out by the plant pathologists were less extensive than the chemical investigations described above. As already mentioned, the country in the smoke zone was largely agricultural, the orchards and native trees not being of particular importance. The methods of diagnosing smoke injury is based on the study of the lesions produced; the markings, shrinkage, and coloration of the affected parts of the foliage; the general health of the plant; the microscopical examination of the injured tissues, particularly the cell shrinkage and the condition of the cell contents, and on certain microscopical reactions to determine the nature of these contents. The plant pathologists are of the opinion that there is no

difficulty in distinguishing between the damage caused by smoke and that due to disease. They point out, however, that many diseased conditions, popularly supposed to be due to smoke damage, are in reality caused by fungous or bacterial diseases. As in the case of the grain crops, some excellent coloured plates are given showing the typical appearance of leaves damaged by smoke.

As the result of the improvements carried out by the Smelting Company at their works, the Commission was able to report that the works were now operated so as to no longer cause injury to the vegetation of the district, or to interfere with the health and comfort of the inhabitants.

The total cost of the investigation was about 27,000 dollars, or approximately £5400. The report extends to 528 pages, and contains an excellent bibliography, compiled by the Chemists' Club Library, of previous work on the effect of sulphur dioxide on vegetable and animal life.

As already mentioned in the introduction to this paper, the appointment of the Selby Smelter Commission is a valuable object-lesson to us in this country as to how disputes of this kind should be decided.

Our methods of settling similar disputes are most unsatisfactory, and there is probably no branch of legal procedure in which the necessity for reform is more urgent. In all such cases the Court should have the assistance and advice of one or more Assessors, who should be men of high standing in the department of science involved, and who should have no partisan interest in the case. At present the verdict depends too much on the skill of the expert witnesses undergoing cross-examination, and on the ability of counsel employed, and too little on the real merits of the case.

It is to be hoped that in the schemes of reconstruction after the war, about which so much is heard at present, the necessity for the reform of our present legal procedure in scientific cases will not be overlooked.

18. Forestry Training for Discharged Soldiers and Sailors.

The following correspondence on this subject has passed between the President of the Society and the Secretary of the Board of Agriculture for Scotland :—

BOARD OF AGRICULTURE FOR SCOTLAND,
29 ST ANDREW SQUARE,
EDINBURGH, 15*th November* 1917.

His Grace The Duke of Buccleuch, K.T.,
Dalkeith House, Dalkeith.

MY LORD DUKE,—I am directed by the Board of Agriculture for Scotland to state that, in view of the present dearth of working foresters and of technically qualified head foresters, they are considering the measures to be taken to make good the deficiency and to meet, so far as possible, the demand (which will probably then be much more acute) for this class of labour at the end of the war.

The Board have in view the training of discharged soldiers and sailors for this purpose, but they feel that their object can only be secured with the assistance of landowners who would be willing to make available their woodlands and the services of their head foresters for instructional purposes.

With the assistance of the Ministry of Pensions, the Board would propose to select for training men of a certain physical fitness who evinced a desire for the adoption of forestry as a career. These men could be immediately employed on the lighter operations of planting during the winter and on nursery work in the spring. They would probably be fit for half days' work only for some weeks. During this time they would receive some training in general forestry operations. For this the Board must rely upon private estates, and they would be glad if you would be good enough to co-operate with them in the matter.

It is anticipated that the men would be in receipt of an allowance from the Ministry of Pensions while under training, and that it would therefore be unnecessary to pay them a wage until they were competent. It is understood, however, that the head forester would be willing to undertake the practical training of the men in the various phases of the work which

in ordinary course fall to be done. The Board would endeavour to arrange for lectures and special demonstrations, but the main part of the instruction would be practical. It would be a great advantage also if the estate could secure reasonably cheap facilities for the accommodation and subsistence of the men.

At the end of a few months it is anticipated that the men would be in a position to earn wages as working foresters, and they would be withdrawn from the estate to whatever employment could be found for them, unless you wished to employ one or more yourself.

The Board are anxious to provide special facilities for the advancement of men who show marked promise in the work, and propose to draft these men, who would be carefully selected from the working party, to training centres where they could obtain a longer and more technical training designed to fit them for posts as forest foremen.

If you are favourably disposed towards the scheme the Board would be glad to hear from you, and to learn what number of men you might be able to take if the necessary arrangements can be adjusted.—I am, My Lord Duke, your Grace's obedient servant,

H. M. CONACHER.
Secretary.

To this letter the President returned the following reply:—

THE LODGE,
LANGHOLM, *3rd December* 1917.

The Secretary,
Board of Agriculture for Scotland,

SIR,—I have received your letter of the 15th ultimo, stating that in view of the present dearth of working foresters and of technically qualified foremen, the Board of Agriculture for Scotland are considering measures which might be taken to make good the deficiency, and to meet, so far as possible, the future demands for this class of labour. I note the method of training which the Board, in conjunction with the Ministry of Pensions, have in view.

The scheme appears to have considerable possibilities if it can be worked out on really practical lines. The scarcity of skilled foresters, and especially of competent and energetic foremen, was, I think, generally experienced even before the outbreak

of the war. That, at least, has been my own experience. Unless something can be done to attract men to this occupation and to provide suitable training, the scarcity is, I fear, likely to remain as great, or even greater, after demobilisation and the return of men to civil employment. The standard of forestry wages has, no doubt, been comparatively low in the past, for the reason that had they been any higher it would have been practically impossible to produce timber except at a loss. Forestry wages have generally corresponded fairly closely with agricultural wages, and are likely to continue to do so and to be permanently higher in the future. These higher wages can only be maintained by a correspondingly higher price for timber. A very large part of the necessary expenses in connection with forestry operations consists of labour, more especially the cost of planting and establishing a new crop of trees. This initial outlay must be kept down if economic forestry is to be possible in Scotland, for the reason that it is cost of planting reckoned at compound interest which is the heaviest item in growing a crop of timber, and which usually determines whether there is a profit or a loss. It is thus absolutely essential, if wages are to be higher than before the war, as I think they necessarily must be, that the average standard of skill should be higher also. I have always been strongly in favour of the system of piece-work wages for felling timber and all other forestry operations where this method of payment can be made applicable. It is a system which has been in practice for some years on my English estates, and the men earn large wages, to our mutual advantage.

With regard to the proposals for training which you have more immediately in view, I will be glad to consider any detailed scheme which may be prepared, and, if possible, to afford assistance in the direction which you indicate by allowing men under training to acquire manual and technical skill by practical forestry work. It would, I think, be difficult to arrange for lecture and class instruction in the outlying districts, and another difficulty which might also arise is that of housing. At the present time in this district, for instance, housing accommodation is almost unobtainable even in the shape of lodgings, owing to the proximity of the Gretna Munition Works.

I would suggest that in selecting men for training it would

be necessary to exclude those who may be physically inferior from wounds or other causes, and also those who are likely to suffer from permanent disablement in some form or other. While I consider forestry employment to be about the most healthy as well as the most interesting and varied of all rural work, it nevertheless demands considerable physical strength, and without this a high degree of skill is of no avail. I would further suggest that quite young men be given the preference, as it is only in rare instances that men over say twenty-five years of age, who have not had previous experience, ever become really expert fellers of timber with axe and saw. These remarks apply more particularly to men who are able to undertake all branches of forestry work, and those of a lower standard of physical fitness might be suitable for work in connection with re-afforestation only.

I would suggest that the training should include a knowledge of hedging and wire-fencing work—more especially the former.—Yours faithfully, BUCCLEUCH.

19. The Coniferous Forests of Eastern North America.[1]

By Dr ROLAND M. HARPER.

THE HEMLOCK (*Tsuga Canadensis*)[2] has a distribution very similar to that of the white pine, except that it is a little more southerly. It grows in several counties of Alabama, in which state the white pine is unknown. It commonly grows mixed with various hardwood trees, and sometimes with white pine besides. It prefers moderately dry soils with a considerable amount of humus, perhaps more than any other eastern conifer. (The states which, according to the last census, cut more hemlock lumber than white pine—making due allowance for the inclusion of more than one species under the same name—have richer soils, on the whole, than those in which the reverse is true.)

[1] Continued from Vol. xxxi. p. 65.

[2] Also called "spruce pine" in Georgia and Alabama, if not farther north. The settlement of Spruce Pine, Ala., takes its name from this tree (see *Bull. Torrey Bot. Club*, vol. xxxiii. p. 524, 1906). and the same may be true of the place similarly named in North Carolina and even of Spruce, Ga.

This tree is confined to situations rarely or never visited by fire, being protected either by the scarcity of undergrowth, or by the topography, or both. It is probably very sensitive to fire, especially when young.

Formerly the hemlock was valued chiefly as a source of tan-bark, and it was once, and still is, in many places as far apart as Michigan and Georgia, a common practice to cut the trees for their bark alone, and leave the logs to rot in the woods. At present it is used largely also for lumber and pulp-wood. The leading states in the production of hemlock lumber in 1909, in proportion to area, were Pennsylvania, Wisconsin, West Virginia, Michigan, New Hampshire, Vermont, Maine, New York, Massachusetts, Connecticut, Maryland and Virginia, in the order named. (The first four of these, as well as Vermont, New York and Maryland, cut more hemlock than white pine.)

The Pitch Pine (*Pinus rigida*) ranges from New Brunswick and Ohio to the mountains of Georgia, but seems to form extensive pure stands only in south-eastern Massachusetts, eastern Long Island, and southern New Jersey. Such forests usually have a dense undergrowth of two shrubby oaks (*Quercus ilicifolia* and *Q. prinoides*), with poor sandy soils, and the ground-water level fairly constant throughout the year.

In its relations to fire the pitch pine seems to be intermediate between the spruces already mentioned and some of the southern pines. The pine-barrens of Long Island and New Jersey everywhere bear the marks of fire, which seems usually not to kill the older trees. Further studies of this point are needed.

This tree is usually too small, crooked or knotty to be of much value for lumber, but where it is abundant it has been used for many purposes, especially in the early days before transportation facilities enabled better woods to compete with it so strongly. The soil in which it grows is of little value for ordinary agriculture, but in wet places among the pines, especially in Massachusetts and New Jersey, large crops of cranberries are gathered. The pine region of New Jersey formerly produced considerable quantities of bog iron ore[1] and glass sand.[2]

The Red Cedar (*Juniperus Virginiana*) grows nearly throughout eastern North America between—but hardly overlapping—

[1] There is an interesting sketch of the old iron industry in southern New Jersey, by Gifford, in *The Popular Science Monthly* for April 1893.

[2] See *The Popular Science Monthly*, vol. xlii. pp. 442, 830, 1893.

the boreal forests of high latitudes and altitudes and the tropical forests of southern Florida. It is most abundant on the north-western flanks of the Alleghanies, in what might be called the interior hardwood region, and forms nearly pure stands, commonly called cedar glades, in middle Tennessee and northern Alabama. (Of the numerous places named Lebanon in the United States it is altogether probable that those in Ohio, Kentucky, Tennessee, Alabama and Florida, if not most of the others, were named from the presence of cedar trees, although our cedar bears little resemblance to *Cedrus Libani*, the classical Cedar of Lebanon.

The soil in which this tree grows is usually dry, and nearly always thin or rocky, but it varies greatly in chemical composition. In Alabama, Tennessee, and some other parts of the country, the cedar is believed to prefer calcareous soils, but this does not seem to be true throughout its range, for it grows in many places where no lime can be detected without a careful chemical analysis.

This species is very sensitive to fire, and the places frequented by it, such as pastures, fence-rows, edges of marshes, dunes, rocks, bluffs, hammocks, etc., are all pretty well protected from fire in one way or another. In fact exemption from fire seems to be the only significant character that its diverse habitats have in common, from which we may conclude that that governs its local distribution more than anything else.[1]

The wood of the cedar is very durable, but is now used mostly for pencils, in which this quality is not taken advantage of. Representatives of the pencil-makers have scoured the country pretty thoroughly for it, and few large straight-grained trees have escaped them, even those in small groves in the most out-of-the-way places in the South. Although it is not separated from some other species in the census returns, the cedar cut in 1909 in Tennessee (8,927,000 feet), Missouri (2,984,000 feet), and Alabama (2,869,000 feet) must be all or nearly all of this species.

The Southern White Cedar or "Juniper" (*Chamæcyparis thyoides*) is the only conifer that grows both in the glaciated

[1] This was discussed at some length in *Torreya*, vol. xii. pp. 145–154, July, 1912. The most complete treatise on red cedar is Bulletin 31 of the Division of Forestry of the U.S. Department of Agriculture, by Dr Charles Mohr, 1901.

region and in the coastal plain and nowhere else. It ranges from New Hampshire to Mississippi, but is not known more than 200 miles inland, or south-east of a straight line drawn from Charleston to Apalachicola (which excludes most of Florida); and there are several large gaps in its range. It usually grows in dense colonies of several hundred trees or more, much like the spruces farther north.

It is strictly a swamp tree, growing naturally only in permanently saturated soil, or peat. The water of these swamps is exceptionally free from mud, lime (perhaps also sulphur) and other mineral substances, but is usually coloured dark brown by vegetable matter. Cities as far apart as Brooklyn, N.Y., and Mobile, Ala., get part of their water supply from streams in which *Chamæcyparis* grows; and the water of Dismal Swamp—one of the best-known localities for this species—used to be preferred for drinking purposes on ships sailing from Norfolk on long voyages. The manufacture of paper is an industry which seems to require good water in large quantities, and the only paper mills in the coastal plain known to the writer (viz., at Hartsville, S.C., and Moss Point, Miss.) have juniper growing in their immediate vicinity.

The relations of this species to fire have been little studied, but what evidence there is seems to indicate that they are much the same as in the case of the boreal forests already described.

The wood is very durable, and therefore used largely for poles, shingles, woodenware, etc., but it is not separated from that of arbor-vitæ and red cedar in the latest census returns.

The Scrub Pine (*Pinus Virginiana*), also known as Jersey pine, spruce pine, nigger pine, cliff pine, etc., bears considerable resemblance to the jack pine previously mentioned, but does not grow within 200 miles of it. It ranges from just south of the terminal moraine in New York and Indiana to central Alabama, nearly always forming dense groves or thickets with little admixture of other trees. It is common in the coastal plain of Virginia north of the James River, but farther south seems to be confined to the highlands. In Alabama its distribution is approximately co-extensive with the coal region, where it is a familiar feature of the landscape. It grows in rather dry, poor, often rocky, soil, but not quite the poorest. In Maryland and Virginia it is very common in abandoned fields, but towards its southern limits it prefers steep rocky bluffs.

This pine, like others with very short leaves, has a thin bark and is quite sensitive to fire, though a light ground-fire does not necessarily injure mature trees. In young thickets fire some times sweeps through the tops of the trees and kills them outright, as in the boreal conifer forests first mentioned. Its local distribution seems to be governed largely by fire, as in the case of the red cedar, for the places where it grows are usually pretty well protected by their isolation, as in abandoned fields, by topography, as on bluffs, or by the sparseness of the undergrowth.

This tree does not often grow large enough to be useful for anything but fuel, charcoal and wood-pulp.[1]

The Southern Short-leaf Pines.—Two species (*Pinus echinata* and *P. Tæda*) which, although they are easily distinguished, have much in common, are called short-leaf pine in the South. The latter is distinguished in the literature of botany and forestry as "loblolly pine," a name which does not seem to be used much by lumbermen and other "natives."

Pinus echinata ranges from Staten Island and southern Missouri to northern Florida and eastern Texas, ascending the mountains of Georgia to an altitude of about 3000 feet, while *Pinus Tæda* grows from Cape May to Arkansas, Texas and central Florida, rarely more than 1000 feet above sea-level. The former grows in dry soils somewhat below the average in fertility, while the latter prefers or tolerates a little more moisture and humus. Both are usually more or less mixed with oaks and hickories, or with each other, so that opportunities for getting satisfactory photographs of them are not very numerous.

The distribution of *P. echinata* corresponds approximately with mean temperatures of 55° to 70°, and *P. Tæda* with about 60° to 72°. The latter does not seem to be capable of enduring temperatures much below zero (Fahrenheit). It may be regarded more appropriately than any other as the typical tree of the South. Where it abounds cotton is the principal money crop, about half the population is coloured, and a large majority of the white voters are Democrats. In South Florida, where it is unknown, there are no cotton fields, few negroes, few southern traditions, and many northern people; and substantially the same might be said of the southern Appalachian region, western

[1] The most complete account of it available is Bulletin 94 of the U.S. Forest Service, by W. D. Sterrett, 1911.

Texas, and several other places just outside of the range of this tree.

Both species when mature have bark thick enough to withstand any ordinary forest fire, and the dead leaves in the woods in which they grow are likely to be burned nearly every year, with little apparent injury to the trees. Trees of either species less than ten years old probably suffer somewhat from fire, however.

Both are very abundant and important timber trees, not far inferior to the long-leaf pine mentioned below, and together they are now being cut at the rate of several billion feet annually. Probably even more trees have been cut by farmers than by lumbermen, for the soil in which they grow is adapted to many staple crops. They reproduce themselves very readily in abandoned fields, however, so that they are in no immediate danger of exhaustion.

THE BLACK PINE[1] (*Pinus serotina*), which looks very much like *P. Tæda*, but is more closely related to *P. rigida* (whose range it overlaps very little, if at all), is strictly confined to the sandier parts of the coastal plain, where the summers are wetter than the winters. It is frequent from south-eastern Virginia to central Florida and south-eastern Alabama, but not very abundant except in eastern North Carolina, where it is the dominant and characteristic tree of the "pocosins." Its favourite habitat is sour, sandy or peaty swamps, where the water-level varies little throughout the year.

Its relations to fire have not been specially investigated. Its wood is similar to that of *P. Tæda*, from which it is not usually distinguished in the lumber markets.

THE CYPRESS (*Taxodium distichum*) is one of our most interesting trees, from several points of view, and a great deal has been written about it. It ranges from Delaware and south-western Indiana to Florida (within two degrees of the Tropic of Cancer) and Texas, and is almost confined to the coastal plain. It is usually abundant where it grows, but more or less associated with other deciduous trees.

This is a swamp tree, growing naturally only where the ground is alternately dry and overflowed. It can stand flooding

[1] This is the name by which it goes in Georgia. In the books it is designated as "pond-pine," a rather inappropriate and perhaps wholly arbitrary name.

to a depth of 8 or 10 feet for a few weeks at a time, and 25 feet for a few days, but does not seem to grow on the immediate banks of the Mississippi and other large rivers whose high-water periods last too long; except near their mouths where the seasonal fluctuations are necessarily less than they are farther up. Its occurrence on the banks of ox-bow lakes which were once part of the Mississippi River may therefore be used as evidence of the minimum age of such lakes.[1] It prefers soil that is rather rich, either from the amount of mineral plant food in the strata penetrated by its roots, or from alluvium deposited by streams.

The regions where this species grow have a mean temperature of about 53° to 75°, a growing season of 180 to 360 days, and an average annual rainfall of 38 to 65 inches. It is successfully cultivated, however, not only in New York, or even farther north of its natural range, but at the same time in ordinary dry soil of parks and streets.[2]

The cypress swamps are pretty well protected from fire most of the time by the wetness of the soil or the absence of inflammable material on the ground, but occasionally in a very dry season fire gets into the edge of such a swamp from the neighbouring uplands and kills some of the trees, whose thin bark renders them rather sensitive.

The wood of our cypress, like that of the Old World tree of quite different appearance which bore the same English name long before ours was discovered by civilised man, is very durable and easily worked, and therefore cut in large quantities for shingles and other articles which are to be exposed to the weather or placed in contact with the soil. The last census reports 955,635,000 feet of cypress as having been sawed in 1909, nearly two-thirds of this amount coming from Louisiana. Next in order were Florida, Arkansas, Mississippi, South Carolina, North Carolina, Missouri and Georgia. (Some of this amount, however, possibly 10 per cent., should be credited to the other species of cypress discussed a little farther on.) The soil in which cypress is found is usually too wet for cultivation and not easily drained, so that in spite of the tree's slow growth

[1] See *Science*, II., vol. xxxvi. pp. 760, 761, November 29, 1912.

[2] In such situations its characteristic "knees," the tops of which in a state of nature seem to indicate the greatest height of water to which the tree is accustomed, are developed on a very small scale, if at all.

and the rapid rate at which it is being cut the supply will probably not be exhausted for many years.

The Long-Leaf Pine (*Pinus palustris*), also known as yellow or Georgia pine, extends through the coastal plain from extreme southern Virginia to the vicinity of the Caloosahatchee River in Florida and the Trinity River in Texas, and also inland to the mountains of Georgia and Alabama, nearly 2000 feet above sea-level. (It almost meets the white pine in Georgia.) In the greater part of its range it is the most abundant tree, and there are or have been many places where it is the only tree in sight. It probably was originally, and may be even yet, the most abundant tree in eastern North America. The long-leaf pine forests, or southern pine-barrens, differ from most others in their open park-like character. Even in a virgin forest of this kind one can usually see about a quarter of a mile in every direction; and the ground is carpeted with wire-grass or other coarse grasses, or with low shrubs.

This species grows best in poor soils, rather dry and sandy and devoid of humus, but never in the very poorest, such as sand dunes. The region covered by it has a warm-temperate climate, with very little snow, and more rain in summer than in winter, except in northern Georgia and Alabama.

After reaching the age of four or five years the long-leaf pine seems to withstand fire better than any other tree known, with the possible exception of one or two of its near relatives to be discussed below; and what is more, it probably could not perpetuate itself very long without the aid of fire. All forests of it bear the marks of frequent ground-fires, which in some places come nearly every year. At the present time, of course, most of the fires are of human origin, but those due to lightning in prehistoric times could spread over much larger areas than they do now, on account of the absence of clearings, roads, and other artificial barriers, so that the frequency of fire at any one spot may not be much greater now than it was originally. A fire every year during the lifetime of the tree would be likely to prevent its reproduction, but in any area that escapes burning for a few years once in fifty years or so, there is opportunity for a new crop of trees.

If fire were withheld too long, the oaks and other hardwoods which grow in the long-leaf pine regions would take possession of the ground, and gradually crowd the pine out, for its seedlings

do not thrive in shade. Proofs of this can be seen in many places in the coastal plain, where fire is barred by the topography, as on bluffs bordering swamps; or by water, as on islands and narrow-necked peninsulas. Such places, in which the soil must have been originally much the same as in the neighbouring pine forests, are nearly always occupied by what is known as "hammock" vegetation, consisting mostly of hardwood trees, which make a rather dense shade and cover the ground with humus.[1]

Few trees in the world are used by more people or in more different ways than the long-leaf pine. For strength and durability combined its wood has no superior among the pines, and it ranks equally high as a fuel. The same tree is our chief source of "naval stores" (*i.e.*, turpentine and rosin).[2] In the regions where it abounds, the log cabin of the small farmer and the mansion of the wealthy lumberman or naval-stores operator are mostly built (from sills to shingles), painted, fenced and heated with the products of this tree. It supplies cross-ties, bridges, depots, cars and freight to many railroads, and motive power to some.[3] The masts, decks and cargo of many a schooner on the Atlantic Ocean are of this species, and some of the busiest streets of our large cities have been paved with blocks of its wood in the last few years. Turpentine and lamp-black from it are found in every drug-store.

As this pine grows mostly in comparatively level ground and almost unmixed with other trees, it has been cut as ruthlessly and wastefully as the northern white pine, and most of the once magnificent forests of it are now scenes of desolation. Although

[1] The idea that fire is essential to the long-leaf pine has been expressed long ago by a few other observers in the south, but has never been generally accepted by writers on forestry, most of whom live in regions where the normal frequency of forest fires is much less. For more extended discussions of the problem see *Bull. Torrey Bot. Club*, vol. xxxviii. pp. 515-525, 1911; *Geol. Surv. Ala. Monog.*, vol. viii. pp. 25-27, 83, June 1913; *Literary Digest*, vol. xlvii. p. 208, August 9, 1913; *American Forestry*, vol. xix. pp. 667-669, October 1913.

[2] The old method of extracting turpentine has been described in *The Popular Science Monthly* for April 1887, and February 1896; and the modern cup and gutter method by Dr C. H. Herty, the inventor thereof, in Bulletin 40 of the U.S. Bureau of Forestry, 1903.

[3] A generation ago pine wood seems to have been the prevailing fuel for locomotives in the coastal plain, but most of the railroads have had to abandon it on account of its growing scarcity.

some other pines are mixed with it in the census returns, it is probably safe to say that at the present time the annual cut of it exceeds that of any other North American tree. Of the 2,736,756,000 feet of "yellow pine" cut in Louisiana and 1,100,840,000 feet cut in Florida in 1909, probably at least 75 per cent. was of this species.

The future prospects for it seem brighter than those of the white pine, for as already pointed out, it is not affected much by fire, the greatest scourge of some of the northern forests. The long-leaf pine's worst enemy at present is the farmer, who in the last two or three decades has been taking possession of the once despised sandy pine lands very rapidly.[1] Notwithstanding the comparative poverty of the soil, the ease with which it can be cultivated and the mild climate are powerful attractions; and where the soil is given over to agriculture the production of timber of course stops.[2]

The Pond Cypress (*Taxodium imbricarium* or *ascendens*) is confined to the coastal plain, from eastern North Carolina (perhaps as far north as the Dismal Swamp) to southern Florida (south end of the Everglades) and eastern Louisiana. It extends over 150 miles inland in the Carolinas and Georgia, but apparently not over 100 miles in Alabama or 60 miles in Mississippi. It seems to be most abundant in Georgia, where it does not form large forests, but is often the dominant tree over several acres, especially in Okefinokee Swamp, where it seems to attain its maximum dimensions.[3]

It grows in poor soils, usually sand, inundated part of the year, but rarely if ever to a greater depth than 5 or 6 feet. (High-water mark is indicated by the height of the enlarged base of the trunk rather than by the knees, which are less

[1] The "wire-grass country" of Georgia, an area of about 10,000 square miles near the centre of the range of this tree, increased in population about 60 per cent. between 1890 and 1900, and 35 per cent. between 1900 and 1910, which necessitated the creation of ten new counties in that part of the state since 1904. Somewhat similar developments have been taking place in the corresponding parts of Florida, Alabama and Mississippi at the same time.

[2] For valuable information about the economic aspects of the long-leaf and several other south-eastern pines, see Bulletin 13 of the Division of Forestry, U.S. Department of Agriculture, by Dr Charles Mohr (1896 and 1897).

[3] See *Science*, II., vol. xvii. p. 508, March 27, 1903; *Bull. Torrey Bot. Club*, vol. xxxii. p. 113, 1905; *The Popular Science Monthly*, vol. lxxiv. pp. 603, 604, 607, 612, June 1909; *The Auk*, vol. xxx. pp. 485-487, October 1913.

characteristically developed in this species than in *T. distichum*). Its favourite habitats are shallow ponds which dry up in spring, and the swamps of coffee-coloured (*i.e.*, not muddy) creeks and small rivers. The regions where it grows have an average temperature of 60° to 75°, a growing season of 240 to 360 days, and an annual rainfall of 40 to 65 inches, over 40 per cent. of which falls in the four warmest months, June to September.

The pond cypress has a thicker bark than its better-known relative, and mature trees are practically immune to fire. The ponds in which it grows are likely to be swept in the dry season by fire, which chars the bark at the bases of the trees a little, but does no perceptible harm.

The wood is very similar to that of *T. distichum* (a little stronger and heavier, if anything), and not satisfactorily distinguished in the lumber trade, but the tree is usually too small, crooked or hollow to be worked up into lumber profitably. It is used principally for shingles, posts, poles, piles, cross-ties, etc. No statistics of its production are available, but it is evidently cut most extensively in Georgia and Florida.

The Southern Spruce Pine (*Pinus glabra*) is sometimes called white pine, or "bottom white pine," on account of its resemblance to the well-known northern tree, to which it is not very closely related, however. It ranges from southern South Carolina to central Florida and eastern Louisiana, in the coastal plain, and never forms pure stands, but associates with hardwood trees, especially the magnolia. It prefers soils well supplied with humus and protected from fire, like the white pine and hemlock, and is usually found in hammocks.

Its wood is softer than that of most other southern pines, and might be used as a substitute for white pine if it were more abundant and better known.

The Slash Pine (*Pinus Elliottii*) is also strictly confined to the coastal plain, ranging from southern South Carolina to south-eastern Mississippi, inland about 165 miles in Georgia, and southward to about latitude 27° in Florida. It is sometimes the only tree on several acres, but is commonly associated with the pond cypress just mentioned, in shallow ponds or in swamps of small streams that are never muddy.

Although it grows naturally only in saturated soil, it sometimes takes possession of comparatively dry ground from which long-leaf pine has been cut off; a circumstance which has led

some uneducated people to believe that the long-leaf does not reproduce itself after lumbering, but mutates into another species. Some writers on forestry also have been misled into thinking that *P. Elliottii* is destined to take the place of *P. palustris* in the not distant future. But the range of the slash pine is much the smaller of the two, and it has shown no evidence of extending its boundaries since it was first recognised as a distinct species, about 35 years ago.

It is not injured perceptibly by fire, except when very young. Its economic properties are practically the same as those of the long-leaf pine, from which it is seldom distinguished in the lumber and naval stores markets. Its distribution corresponds approximately with that of the sea-island cotton crop, except that this cotton is not now raised west of the Chattahoochee River, while the pine extends nearly to the Pearl River.

The Florida Spruce Pine (*Pinus clausa*), a near relative of *P. Virginiana*, is the least widely distributed of all the eastern conifers, being almost confined to one state. It ranges from Baldwin County on the coast of Alabama to Dade County, Florida, about latitude 26°. Like the somewhat similar jack pine of the north, it is confined to the most sterile soils imaginable, where other pines are scarce or absent. Its favourite soil, about 99 per cent. white sand, is most extensively developed in the lake region of peninsular Florida, where it supports a peculiar type of vegetation known as "scrub," consisting mostly of this pine, two small evergreen oaks (*Quercus geminata* and *Q. myrtifolia*), saw-palmetto and several other evergreen shrubs, with very little herbaceous growth: grasses and leguminous plants especially being conspicuous by their absence. Outside of the lake region this type of soil and vegetation is principally confined to old stationary dunes near the coasts.

Fire sweeps through the scrub on the average about once in the lifetime of the trees, as in the boreal conifer forests, and kills the pines completely; but their cones, which normally remain closed for years, then open and discharge seeds for a new crop.

The wood of this pine is of little value, and the soil in which it grows is worthless for ordinary crops. But on the east coast of Florida south of latitude 28°, where frost is sufficiently rare to make such ventures profitable, large areas of old dunes have been cleared of their spruce pines and planted with pineapples.

The pineapple is peculiar in belonging to a family of air-plants (*Bromeliaceæ*), and taking very little nourishment from the soil.

Our southernmost conifer, *Pinus Caribæa*, seems to have no distinctive common name in general use. (It has been called "Cuban pine" by several writers on forestry in recent years, but that name would be more appropriate for *Pinus Cubensis*, a species confined to eastern Cuba.) It is abundant in South Florida, and may extend along the coast to Georgia and Mississippi, though this point has not yet been determined beyond question. It is said to occur also in the Bahamas, western Cuba, the Isle of Pines, and British Honduras. It grows in pure stands, like the long-leaf; and south of the Caloosahatchee River it is almost the only pine, and more abundant than all other trees combined. It is confined to low regions within 100 feet of sea-level, and the saw-palmetto is usually the most conspicuous feature of the undergrowth (in Florida, but not in the tropics, for this palmetto does not grow farther south).

It grows mostly in sandy soil north of Miami, and on limestone rock south of there, where sand is scarce. Although it occupies the driest soils within its range (quite unlike its near relative *P. Elliottii*), the country where it grows is so low that there is usually water within 2 or 3 feet of the surface. The climate is subtropical, with no snow and little frost, and the summers are much wetter than the winters.

This species withstands fire about as well as *P. palustris* and *P. Elliottii* do, or perhaps even better, and is exposed to it as often.

Its wood is similar to that of the long-leaf pine, except that it is more resinous and brittle, and therefore is not used much for lumber except locally where there is no other pine within easy reach. The gum does not flow readily, and consequently very little turpentine is obtained from this species; but it is not unlikely that the increasing scarcity of long-leaf pine may before long bring about the invention of some method for utilising *P. Caribæa* as a profitable source of naval stores. The range of this species lies almost entirely south of the cotton crop, but the soil or rock in which it grows is being planted extensively with grape-fruit, mangoes, avocadoes, and other tropical fruits.

NOTES AND QUERIES.

The Great War.
The Society's Roll of Honour.
Seventh List.[1]

The following names have been sent in since the publication of the Sixth List:—

Fraser, George M., 13 Drumsheugh Gardens, Edinburgh. Lieut., R.F.A. (Spec. Res.). (Wounded, June 1917.)

Gordon, Seton, Auchintoil, Aboyne. Lieut., R.N.V.R.

Jonas, R. C. 2nd Lieut., Royal Engineers.

M'Gran, J., The Gardens, Coodham, Kilmarnock.

Sprot, Colonel Sir Alex., Bt. of Garnkirk and Stravithie, C.M.G.

Rollin, Jacques, France, Legion of Honour, Military Cross. (Killed, 4th May 1918.)

Casualties Intimated.

Moultrie, James, Durris (see Third List). Killed, 26th March 1918.

Park, James, Durris (see Third List). Killed, 13th Nov. 1916.

A Summer School.

Few children have the privilege of being able, during the summer months, to leave the hot, noisy, dull and dusty schoolroom and do their tasks in the cool shade of surrounding trees. Such is the privilege of at least one school in Perthshire. Several other schools may be taken out of doors during the heat of the day, but very little work is carried on as the children are able to see and hear everything that goes on around them. The school of which I write, having a summer school ready-made, there are few temptations to let the mind wander.

The actual school building, like many others, is situated on the edge of a coniferous wood and near the public road. A very short distance behind the school, and almost out of sight of the public highway, is a large rectangular grassy plot, surrounded on all four sides by Douglas firs. This plot is large enough to allow of a class working at either end without disturbing each other. These Douglas firs are planted at such

[1] For First, Second, Third, Fourth, Fifth, and Sixth Lists see Vol. xxix. p. 192, Vol. xxx. pp. 47 and 129, Vol. xxxi. pp. 66 and 168, and Vol. xxxii. p. 97, respectively.

a distance that, at their present height of about 10 or 15 feet, their lower branches are so close, thick, and bushy that it is almost impossible to see anything beyond the rectangle. Entrance to this outdoor school is at one corner, where much traffic has kept the branches short. All around are other conifers, chiefly Scots pine, which shelter the children at work there from the sun's rays. The young Douglas firs are also now beginning to share in this work.

Some one has gone to great pains in the planning and making of the plot, and the children love the summer school. Promised to go there in the afternoon, they work twice as well beforehand. In the hot, dark class-room they become weary, listless, and sleepy; in the open they are all alive. The noise of feet and slates, especially in the infant department, is at times almost unbearable; all noises vanish in the summer school. It is especially an advantage for drill and nature study. Drill in country schools is apt to be composed of only a few uninteresting, monotonous, simple exercises, since movement is very much restricted. In this selected spot all free-standing movements, with running, jumping, and games, which make the children healthy in mind and body, can be indulged in. If permitted to use their voices the drill is all the more like fun, and still there is no excess noise. Nothing could be better than to study nature in the open air. The children take far more interest in the subject when all around tells of it than if, within four solid walls, they had to imagine it all. They begin to love nature study for nature's sake.

Space is also an advantage. All children can be placed on the ground so that every one is seen at a glance, and yet no one requires to be near his or her neighbour. The work done in the summer school has not the sameness, this child's to its neighbour's, as that done within doors. A test set in the open is worth far more than one set in the schoolroom.

Another, though perhaps secondary, use this school is put to is during the midday interval. There are always some children who have come with unprepared work. In the summer school, under the eye of the teacher, this wrong is righted, and yet the children have the benefit of fresh air and sunlight all the time. Even work at this time can be carried on without disturbance from the free pupils; the eye of the most curious cannot penetrate the dense screen.

I have mentioned that other schools sometimes work out of doors, but seldom. Why? Often it is the teacher's fault. He or she is unable to face the public passers-by, and have his or her manner and doings criticised by them. It is more pleasant to the teacher to stay within. This is entirely overcome in an outdoor school with walls of living trees. I have noticed classes from our town schools having lessons in the open air, but apparently they only stay for a very short period. The work in this country school is so planned during the summer that the children are in the summer school for a considerable time at a stretch—perhaps a whole forenoon, perhaps a whole afternoon.

Disadvantages, of course, there are. The chief disadvantage is not inattention, although many would think of that first. It is that work in this summer school is limited. The only pieces of furniture in the "room" are the teacher's chair and a very few old forms. Only oral work and slate work can be carried out, and only oral work to a certain extent, for a blackboard is a great aid in such work, and a blackboard is wanting; a slate is used, but not successfully. In the higher classes this limitation is felt more than in the infant department, since practically all work is done on paper.

Inattention and seeking for diversion are always confined to the first day or two of each season spent in the summer school. The novelty wears off, and wanderings can always be treated as they deserve. To show how the children enjoy the life, return to school is always the worst punishment. And again, what diversion can be got? Only what nature supplies, since one cannot see beyond the four walls of trees. The public road is hidden, and only the roof of the school is seen.

On wet days work in the outdoor school is impossible, and even on dewy mornings the children cannot be taken out early. Under circumstances such as those of this Perthshire school there need not be an unhappy child during all the summer months. And yet it is not play. One does not feel that time is being wasted, or that the children are learning nothing. Work goes on the same, but under ideal conditions, and it is only a pity that this school does not use its summer school more, and that all schools, where it is possible, were not supplied with an outdoor school of a similar type.

M. Murray.

Employment of Girls in Forestry Work.

Mr John Waddell, forester, Foswell, Auchterarder, sends the following notes in regard to work done by two girls on this estate in the period from 1st December 1917 to 30th March 1918, in replacement of male labour.

For the first two months the work done was the thinning and pruning of a plantation of about 35 acres in area, age twenty years, situated at an elevation of from 900 to 1000 feet. The girls worked in the plantation in all kinds of weather, except when the trees were hanging with snow or the weather very wet. They were very keen to learn, and after the first week or two could be left to work by themselves, except that the trees to be cut out were marked, and assistance given in carrying out the cut trees, some of which were too heavy for the girls. A considerable number of the trees were put into a shed, and when it was snowing or very wet, the girls cut them up there into pit-prop lengths. They soon learned to take the gauge of the points of the props and also the lengths, and to pile the props up neatly into the different sizes. At the time of writing (13th April) two waggon-loads of pit-props had been sent off, two other waggon-loads were ready to send off, and there was still a quantity to cut up into lengths.

In addition to thinning the plantation the girls have done planting, mostly beating-up, as it was not possible to get material for new fences to take in new plantations this year. The girls proved fairly good with the spade. They had previously done some garden work, which no doubt helped them.

They also assisted in felling heavy larch trees for fencing and other estate purposes. In cutting the heavy trees with the cross-cut saw, the two girls were stationed at one end of the saw, one taking the saw-handle and the other a short rope attached to the handle. The latter assisted by pulling the rope at the same time that the first girl pulled the handle. On the second day of work the two girls and the forester cut off root eight larch trees, and also sned and cross-cut them into post lengths and burnt the branches. The trees would average about 25 cubic feet each.

In the last fortnight of work wire-fencing was erected, and here difficulty was experienced, though the girls got on fairly

well after the first. In eight days, with their assistance, 520 yards of fencing were erected, with 5 ft. 3 in. posts, and seven wires, 3 ft. 6 in. high. The heavy work was done by the forester, but the girls held the posts, rolled out the wire, assisted with other things, and also drove most of the staples. They proved also very handy at nursery work, their gardening experience helping them here. The work done was mostly transplanting into the ordinary nursery lines, and lining out seedlings from the seed-beds.

The girls were quite useful at most kinds of work after they had been shown how to do it, but of course those taking up the work must make up their minds to stay at it for some time, for some teaching is required before they can handle all the different tools used in forestry and other estate work.

Steel Ships and Need of Timber, 1913.

Mr J. H. Milne-Home points out that in the note on this subject which appears in the January issue, page 104, there is an error in the figures given as to the area of woodland which would be necessary to grow the timber required for the industries of the Clyde area. The figures given for area should have been divided by 40, to allow for the year's growth of 40 cubic feet per acre. Thus the area required to grow the timber used in the shipbuilding industry of the Clyde should have been 50,000 acres, and that for the requirements of the industries of the whole Clyde area 290,000 acres, instead of the figures given in the note.

Paper from Saw-dust.

Some important investigations which have been carried on by Mr Hall Caine, jun., the Deputy-Controller of Paper under the Board of Trade, and Mr Frederick Becker, the head of the Donside Paper Company, have led to the possibility of saw-dust being used on an extensive scale for the manufacture of paper suitable for newspapers. The saw-dust is first of all converted into wood-flour in grinding mills, and green saw-dust, or saw-dust from the conversion of timber which has been recently felled, can be ground finer than dry saw-dust, and is more suitable than the latter for the manufacture of saw-pulp.

Hitherto wood-flour, though used for a variety of other technical purposes, has only been utilised in the manufacture of pulp to a small extent. For the manufacture of the saw-pulp used at the Donside Paper Works a grinding mill was acquired at Kinghorn, Fife, and as a result of the experiments which were carried out with this material at the paper mills, it was found that the most satisfactory results could be obtained by mixing the saw-pulp to the extent of 35 per cent. with 30 per cent. of waste (paper), or altogether 65 per cent. of home material and 35 per cent. of imported pulp, the proportions which had previously to be used being about 70 per cent. of imported pulp as compared with 30 or 40 per cent. of home materials. It is estimated that 20,000 tons per annum of saw-pulp can be obtained from the United Kingdom, which would form a considerable addition to our paper-making materials.

P. L.

REVIEWS AND NOTICES OF BOOKS.

French Forests and Forestry. By THEODORE S. WOOLSEY, Jun., M.F., Lecturer, Yale Forest School. New York: John Wiley & Son. London: Chapman & Hall, Ltd. 238 pp., 20 illustrations. 11s. 6d. net.

Most of the earlier books written by members of the United States Forest Service were of a popular type, and intended to interest the public in forestry. Lately, however, books of considerable interest and service to the forestry world have been produced.

The present volume purports to embody "the results of a study of the more important phases of forest practice in Corsica, Algeria, and Tunisia." No attempt is made to give a complete investigation of forestry in all its branches. Nor does the writer summarise all the details of administration; he rather aims at setting forth the essentials of method applicable to the United States or of value to English-speaking foresters. Only methods and results are set forth, and no comparisons are made.

The book is divided into three main parts, namely, Tunisia, Algeria, and Corsica. There is also an appendix giving a

translation of the Algerian Forest Code; statistics of Federal Forests in Corsica, and also a specimen Sale Clauses. As contrasted with France proper, forest administration in these dependencies is extensive. In addition, conditions are frequently such as to render rigid working-plans impracticable. This is especially the case in Tunisia, where fires and irregularity of markets render systematised workings for timber production extremely difficult. In this country the cork oak is the main economic forest species. The times for harvesting cork are regulated mainly by the period required for a given thickness to be attained. The author gives interesting figures regarding the production of cork and timber, and the prices obtained.

The Forest Service in Tunisia has under its care several valuable oases. These oases are not of the single well type, but are formed by many springs which occur around the perimeter of the fertile ground. The interior is usually a rich date farm yielding as much as 18,739,260 lbs. of dates. The chief dangers to the wells are from drifting sands and erosion. Effective measures for combating these are described. On the whole, costs of protection seem high, but they are justified by the value of the property saved.

Forest administration in Algeria is slightly more intensive than in Tunisia. It has been found, however, that the exact rules of French forests are not such as can be applied to the conditions that prevail in Algeria. Modifications suggested by the Jonnart Commission are proving satisfactory.

The Algerian forests are estimated to cover about 7,000,000 acres, and, as a rule, only occupy land which cannot be cultivated profitably. Continuous stands are formed by various species of *Quercus*, Aleppo, and maritime pines, *Cedrus atlantica*, *Callitris quadrivalvis*, and *Juniperus phœnicia*. Of these *Quercus suber* and *Q. mirbickii* are most important. The pines and cedar are only being developed. Owing to great droughts the reafforestation problem is a weighty one. The only successful methods seem to be the planting of small ball plants, and by direct sowing. The systematic experiments for the regeneration of Aleppo pine are interesting and instructive.

In the part dealing with Corsica, British foresters will find much interesting matter relating to the growth and management of Corsican pine. The author states that this tree may attain a height of 148 to 164 feet, with a diameter reaching

to 6·5 feet. Contrary to the general experience in Britain the tree is said to be slow growing, and the rotation advised by the Forest Service is the very long one of 360 years. This rotation is thought necessary to supply large timbers, and to make up for overcutting in the past. The maritime pine grows quickly and is tapped for resin.

Conditions in the American Service make fire-fighting one of the main works allotted to foresters, and the frequent reference to fire dangers is thus accounted for. Grazing is another danger fully discussed, and will be of special interest in America.

The work is marred by many errors in converting from metric to English measures. Such errors as the following are frequent:—"a tree 70 m. (27 inches) in circumference would be peeled to a height of 1·75 metres (6 feet) above the first incision"; in different places the stere is given as equal to 36 and 35 cubic feet; 1·5 metres is given as equal to 7 yards. There are also errors in the classification and spelling of plant names, *e.g. Euphorbia* and *Atriplex* are called grasses, *Callitris* is spelled several times *Callistris*. The book is instructive, and consideration of the methods described would repay anyone whose work is in countries similar to Corsica, Algeria, and Tunisia. The author promises a volume on French continental forestry which will contrast with the present volume by dealing with more intensive management. J M. M.

Mental Reckoning Tables. By A. Murray, Forester, Murthly. James H. Jackson, 26 High Street, Perth.

As a means of ascertaining rapidly and accurately the cubic contents of round, square or unequal-sided timber, it would be difficult to imagine anything simpler or easier than the method adopted by Mr Murray in the compilation of these tables. From the tables, which are fifty in number, the superficial contents of the transverse section of any piece of timber to be measured can be obtained at a glance, and this multiplied by the length gives the cubic content without further trouble. A specially prepared table gives, on the same principle, the cubic content for round timber with an allowance of 10 per cent. for bark. The true cubic content can be obtained from another table, which gives sectional areas with their correspond-

ing diameter, circumference, and quarter-girth measurements. The sectional areas are given in square feet and decimal fractions of a square foot, while the diameter, circumference and side measurements are given in inches and quarter inches. Great care has been taken to secure accuracy in the compilation of these tables, and we can warmly recommend them to all those who have to do with the measurement of square, round, and unequal-sided timber.

Estate Economics. By ANDREW SLATER. London: Constable and Co., Ltd., 1917, pp. xiii + 264. Many illustrations.

The above book is planned and written as a guide to landowners, land agents, factors, foresters, and others. The subject matter is dealt with in a short and concise manner.

About a third of the book is devoted to forestry, and the chapter (XI.) which deals with this subject has been especially written for the book by Mr A. D. Richardson, the well-known authority on trees and shrubs, and a member of the Society. This chapter is divided into twelve sections, which cover the various divisions into which forestry may be grouped. The writer has treated the subject in a scientific and practical manner. It is rare to find a writer who combines both these phases of knowledge concerning forestry, and the reader cannot fail to appreciate the intimate relationship which exists between the technical and practical sides of the subject. The opening chapters, which are devoted to the origin of soils, drainage, embanking of rivers, construction and maintenance of roads, fencing, gates, etc., will be found of equal interest and value to the forester and farmer.

The following chapters deal with buildings, water-supply, sewage drains, etc., and the utilisation of land and motor traction. The information given in these chapters is also based on long and intimate practical experience in estate economics, and at the present time the accumulated experience of years of observation and study will be found of great use.

Throughout, the work is illustrated by many carefully executed drawings, prepared by Mr Andrew Slater, jun. An appendix, containing legal and other notes, is given and forms a very useful addition to a work of this kind. One or two

slips of a minor character occur, but these are not of such a nature as to impair the high value of the book. To those interested in problems of reconstruction, and especially land development and utilisation, the book can be recommended as a helpful and suggestive guide, especially as it is founded on practical experience and knowledge of modern principles.

Forestry Work. By W. H. Whellens. Price 8s. 6d. net. T. Fisher Unwin, Ltd., London.

This book is a useful addition to our forestry literature. The author is a forester of wide experience, and one who can claim to speak with authority on the subject. Mr Whellens has had charge of some important forestry estates in the British Isles, and has conducted forestry operations with marked success on the various estates with which he has been connected. The book he now offers to the public is the result of practical experience and first-hand knowledge of the subjects with which he deals, and it cannot fail to be a very helpful guide to young foresters and others who are interested in the study and practice of silviculture. The author gets to business straight away, and carries the reader, step by step, through the various details of the work and methods involved from the raising of plants to the clearing of the crop. There are a number of illustrations showing different kinds of tools and instruments used in forestry as well as plans and sections, which add to the usefulness of the book. An appendix contains a number of very useful tables, and other information required in the practice of forestry. A full index is added which makes the book very convenient for reference.

In the preface the writer expresses his thanks to Mr R. Galloway, for his encouragement and for his kindness in reading through the MS. and making suggestions.

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON:

HIS MOST GRACIOUS MAJESTY THE KING.

PROCEEDINGS IN 1917.—*Continued.*

THE GENERAL MEETING.

The General Meeting of the Society was held in the Y.M.C.A. Rooms, 70 Bothwell Street, Glasgow, on Wednesday, 11th July 1917, at 11 o'clock. Sir ANDREW AGNEW, Bart., President, occupied the Chair.

MINUTES.

The Minutes of the Annual Meeting, held on 7th February last, which had been printed, were, on the motion of the Chairman, held as read and adopted.

APOLOGIES.

Apologies for absence were intimated from Lord Forteviot, Sir Kenneth Mackenzie, Colonel Stirling, M.P., Lord de Vesci, Sir Robert Wright, Sir Arch. Buchan-Hepburn, Colonel Malcolm of Poltalloch, Dr Somerville, and Messrs Robert Allan, J. A. Duthie, P. Leslie, Charles W. Ralston, D. K. M'Beath, John T. Calder, James C. Calder, and John M'Kerchar.

JUDGES' REPORT ON ESSAYS.

The SECRETARY reported that two Essays had been received, and the Judges' awards were as follows:—

1. "The Reclamation of Waste Land by Afforestation." By W. H. WHELLENS, Thoresby Park, Ollerton, Notts. Award—a No. 2 Silver Medal.
2. "The Trees of Thoresby Park." By W. H. WHELLENS, Thoresby Park, Ollerton, Notts. Award—a No. 3 Silver Medal.

Enemy Members.

The Secretary said: "The Council recommend that the names of any of our enemies which happen to be on our list of members should be deleted. I think we have very few, and I hope this meeting will homologate what the Council propose should be done."

This was unanimously agreed to.

Development of Afforestation.

In his remarks on this subject, the President made special reference to the Statement submitted by the Council, in April last, to the Forestry Sub-Committee of the Reconstruction Committee. Sir Hugh Shaw Stewart moved the approval of the Statement. This was seconded by Mr Paton, Kilmarnock, and unanimously agreed to. (The Statement is printed on pp. 81-91 of Vol. xxxi. of *Transactions*, and a full report of the speeches will be found on pp. 49-72 of Vol. xxxii.)

Discussion.[1]

A discussion on National Forestry was opened by Sir John Stirling-Maxwell. Statements on the following branches of the subject were afterwards submitted:—(1) "On the Utilisation of Timber by Railways," by Sir Charles Bine Renshaw, Bart., Chairman of the Caledonian Railway; (2) "On the Utilisation of Timber by Mines," by Mr Charles A. Carlow, of the Fife Coal Company; (3) "On Forestry in relation to Deer Forests and Sheep Farms," by Col. Stirling, M.P., and Mr D. K. M'Beath; (4) "On Forestry Education," by Dr Somerville. The meeting then adjourned for lunch.

On resuming, the Chairman called upon Miss Macdonald, Agriculture Co-operating Officer, who made a statement upon work for women in connection with agriculture and forestry.

The Chairman then declared the meeting open for general discussion, when the following took part, namely, Messrs Hamilton, Borthwick, Broom, Fraser, Spiers, Richardson, and Sir John Stirling-Maxwell.

Mr Fraser moved that the Council should ask the Secretary

[1] A full report of the discussion will be found on pp. 6-38 of Vol. xxxii. of the *Transactions*.

for Scotland to receive a deputation. Sir JOHN STIRLING-MAXWELL seconded this proposal, which was unanimously agreed to.

The CHAIRMAN then moved a vote of thanks to Sir John Stirling-Maxwell, Mr Carlow, and the other speakers.

On the motion of Mr PRICE a vote of thanks was accorded to Miss Macdonald.

Mr BUCHANAN moved a vote of thanks to the Chairman, which was unanimously adopted, and the proceedings came to an end.

Royal Scottish Arboricultural Society.

Instituted 16th February 1854.

PATRON:

HIS MOST GRACIOUS MAJESTY THE KING.

PROCEEDINGS IN 1918.

THE ANNUAL MEETING.

The Sixty-fifth Annual Meeting of the Society was held in the Goold Hall, 5 St Andrew Square, Edinburgh, on Wednesday, 20th February 1918, at 11.30 A.M., when about fifty-five members were present. Dr GREIG, of the Board of Agriculture for Scotland, represented the Board at the meeting.

APOLOGIES FOR ABSENCE.

Apologies for absence were intimated from Lord Lovat, Lord Forteviot, Lord Lyell, Colonel Martin Martin, Messrs Milne Home, Duthie, Fraser, Annand, Gordon, Garrioch, D. Munro, J. A. Alexander, J. Boyd, J. M'Kerchar, and A. D. Hopkinson.

REPORT BY THE COUNCIL.

The Secretary read the following Report:—

Roll of Honour.

The fifth and sixth lists of the Roll of Honour were published in the last two issues of the *Transactions*. These lists contain 27 names, which, with those included in the previous lists, make a total number of 259.

The fatal casualties during the past year, so far as ascertained, were Captain M'Arthur, Inveraray; Captain T. A. Nelson; Mr Thomas Campbell, Nairobi; and Mr Duncan Macpherson, East of Scotland College.

Honorary Members.

It will be seen from the Note of Business before the meeting that the Council recommend the election of six eminent foresters and arboriculturists for this honour, and since the list was printed the Council has added another name to the list—that of Mr John Renwick, who has done distinguished work as an arboriculturist for many years in the West of Scotland.

The names of two enemy subjects have been removed from the list of Hon. Members, in terms of the Council's recommendation adopted at the General Meeting in Glasgow.

Membership.

The death of the following civilian members has been recorded:—Mr Alex. Lamb, Forgandenny; Mr D. S. Carson, Glasgow; Mr Wm. Milne, Foulden Newton; Mr C. F. H. Bolchrow of Brackenhoe; Mr James Porteous, Coldstream; Mr James Kay, Rothesay; the Earl of Haddington; Mr Samuel Margerison; Mr Geo. R. Fortune, Colinsburgh; Bailie Inman, Edinburgh; Mr George Cowan, Edinburgh.

Seven members have resigned and 30 have been removed from the Roll owing to lapsing and other causes. On the other hand, 87 new members have been elected, and the total membership is now 1373, being 35 more than last year.

Appeal for Members.

A letter addressed particularly to large users of wood and other forest products, inviting them to become members of the Society, had the effect of securing a considerable number of new members, particularly in the West of Scotland.

Transactions.

The usual half-yearly parts of the *Transactions* have been issued. The January part was somewhat delayed in order that the recommendations of the Forestry Sub-Committee of the Reconstruction Committee might be included in it. The part has now been issued to all members who were not in arrear with their subscription at the close of the year. Any member who may not have received his copy should communicate with the Secretary.

Essays.

Two essays were received in the course of the year and submitted to the Judges, who awarded a No. 2 Silver Medal for the one and a No. 3 Silver Medal for the other. The writer of both essays was Mr W. H. Whellens, lately of Thoresby Park, Ollerton, Notts.

Development of Afforestation.

Immediately after the last Annual Meeting a letter was received from the Secretary of the Forestry Sub-Committee of the Reconstruction Committee asking the Society's advice on the subject of the reference to them, namely—The best means of conserving and developing the woodlands and forestry resources of the United Kingdom, having regard to the experience gained during the war. This letter was considered at the first meeting of the Council held after it was received, and a statement was drawn up and presented to the Sub-Committee. This statement was subsequently printed in the *Transactions*, and was adopted by the General Meeting of the Society held in Glasgow in July. It was also, with the approval of the Reconstruction Committee, sent to all Scottish M.P.'s and Government Departments concerned. Two of the Development Commissioners, Sir William Haldane and Sir S. Eardley Wilmot, who are members of the Society, sent letters disapproving of the views expressed in the statement.

The report of the Forestry Sub-Committee of the Reconstruction Committee has now been published. Its recommendations, and also an article on it entitled "Forestry Reconstruction," by Colonel Stirling of Keir, have been printed in the *Transactions*. Members will have an opportunity to-day of listening to a number of speakers setting forth the main provisions of the report, and of afterwards taking part in the discussion following upon the motion to be submitted by Sir Andrew Agnew.

On 11th August, the Secretary for Scotland received a deputation of the Council and a representative from the Aberdeen Branch, in Edinburgh, when views were exchanged regarding the future of forestry. A full report of the meeting is printed on pp. 49-72 of the *Transactions* recently issued (Part 1 of Vol. xxxii.).

In view of meetings between the Secretary for Scotland and the Scottish Chamber of Agriculture, at which forestry was discussed, the Council approved of the President making a public pronouncement defining the position which the Council had adopted. A letter was accordingly approved and sent to the press, and an interesting correspondence followed, which no doubt members are familiar with. A resolution asking for the return of Mr Sutherland to his position at the Board of Agriculture was also sent to the Secretary for Scotland, the Board of Agriculture, and Mr Sutherland himself. An invitation was also sent to the Council of the Scottish Chamber of Agriculture to appoint a Committee to confer with the Council of this Society regarding the points on which there might be conflict of views between agriculturists and foresters. The invitation has been accepted subject to conditions, but the Committees have not yet met.

Education—Forestry and Young People.

Several editions, numbering in all 4000 copies, of the small book written by the President for the Society, entitled *An Introduction to Forestry for Young People*, have been printed. Presentation copies were sent to the author, the contributors to the fund, Sir John Struthers, Secretary of the Scotch Education Department, and others. A list of headmasters in rural schools was then compiled, with the help of the organisers of Continuation Classes, and the interest and co-operation of H.M. Inspectors were secured through Sir John Struthers. A copy of the book, with a covering letter, was then sent to these schoolmasters, and a large number of replies have been received, conveying thanks, offering suggestions, or asking for additional copies or for further advice. In all about 2350 copies of the book have been distributed to schoolmasters, the press, and others, 1380 have been sold, and there remain on hand about 300, to meet the demands for further copies which are being dealt with. The Council has since arranged with the agricultural colleges to allow their lecturers to deal with all cases in their districts where teachers desire advice in starting or developing school nurseries, or wish further expert advice. The North of Scotland Provincial Training Committee are considering a suggestion by the Council that they should make arrangements for providing vacation classes in forestry for schoolmasters.

The Committee have decided to extend the educational work by either adding to the book or writing another book carrying the subject further, as soon as it becomes apparent that there is a real demand for it.

The Council has received with gratification a further donation of £25 to the Education Fund from Sir W. Rowan Thomson.

A Committee, appointed to consider the Education (Scotland) Bill, submitted the following report which was unanimously adopted and was sent to the Secretary for Scotland and the Secretary of the Scotch Education Department :—

1. That Vacation Classes in forestry should be instituted for the benefit of rural schoolmasters who desire to qualify themselves to teach forestry as a branch of Nature study.
2. That forestry, as a branch of Nature study, should be included in schemes of education in rural schools situated in districts where the subject is likely to be useful.
3. That Continuation Classes in forestry should be established in suitable centres throughout the country, and the necessary facilities for attendance provided where required.

4. That a course in forestry should be provided at the Agricultural Colleges, to be supplemented as soon as practicable by employment and instruction in Demonstration Areas.
5. That scholarships should be provided to enable students to attend a university or college for higher instruction in forestry and allied subjects, with the view of obtaining the degree of B.Sc. in forestry.

Vermin and Game Pests.

A Memorandum, prepared by Sir William Haldane, on this subject was considered by a Committee, which reported that all forestry pests should be dealt with by experts under the Forestry Authority, and not as suggested in the Memorandum by popular bodies such as County or District Councils, who were considered unqualified to deal with such a subject.

The Council, following up the discussion which took place at the Annual Meeting on the subject of danger to standing trees from insect and other forest pests, owing to the accumulation of brushwood and other waste material left on the extensive areas cleared of timber for national purposes, communicated with the Board of Agriculture with the view to measures being adopted to prevent probable damage. A circular on the subject was afterwards issued by the Board warning owners of woodlands and others of the danger, and suggesting measures to be adopted to combat the pests.

Scottish Council of Agriculture.

Mr G. P. Gordon and the Secretary represented the Society and attended the meetings, but the only point directly bearing on forestry considered during the year was the application to forestry of the provisions of the Corn Production Bill. It was agreed that forestry should be excluded, and that forestry in this case should be held to include forest tree nurseries both public and private.

Comparative Report on a Wooded Area and an Unwooded Area.

Sir John Stirling-Maxwell has been good enough to present a sum of £100 to account of the expense of obtaining a report on a wooded area, comparing and contrasting it with an adjoining unwooded area, with the view of ascertaining the value of the silvicultural factor in the economic development of a district.

Income Tax, Excess Profits Duty, and Death Duties.

The Board of Agriculture and Fisheries has issued a Memorandum on these subjects, which may be obtained gratis from the Board of Agriculture for Scotland, 29 St Andrew Square, Edinburgh.

Valuation of Woodlands.

Considerable discussion took place in the course of the year regarding a case decided by a Local Valuation Committee, in which the proprietor of woodlands endeavoured to obtain a decision to the effect that in "natural state" meant in their unimproved state, as against the Assessor's contention that it meant in the actual state after being divested of trees. The Local Committee upheld the Assessor's contention. The Council appointed a Committee to confer with the proprietor's agent on the subject of a test case, but decided that the Society should not be expected to incur any expense in fighting such a case—that being the duty of owners of woodlands.

Women and Forestry.

At the request of the Agricultural Organiser, who mentioned that hundreds of women were offering their services for work on the land, the Council agreed to help in finding places for them. A similar request by Mr Gordon, in regard to women trained in forestry at the West of Scotland Agricultural College, was also agreed to.

Scottish Women's Rural Institutes.

Some communications with the Board of Agriculture and others on the subject of these Institutes took place, but no formal request had been as yet received by the Society to send a representative to the Board of Management.

Location of Meetings.

A suggestion that Council and General Meetings of the Society might be held alternately in Edinburgh and Glasgow was considered by a Committee, who recommended that the next General Meeting of the Society, which, in ordinary course, would have been held in the Showyard of the Highland and Agricultural Society, should be held in Glasgow, and the meeting of 11th July last was accordingly held in the Christian Institute there.

Presentation of Photographs.

The Council accepted with thanks five photos of a Scots pine wood at Ween near Hawick, which were presented by Mr W. M. Price, factor on the Minto Estates.

Mr France's Action against the Society.

Proof was taken and judgment given against Mr France who was found liable in expenses. The Account of Expenses was made up and taxed, decree extracted, and a charge given to Mr France in the usual way. Mr France replied that he had no means and could not pay. The Council were of opinion that in the circumstances such a letter should have been accompanied by an offer to resign his membership, and he was accordingly asked to resign. A correspondence took place with the Aberdeen Branch on this subject, and, on the suggestion of the President, it was agreed, in deference to the unanimous desire of the Aberdeen Branch, that the proceedings for expulsion against Mr France should be allowed to drop.

Dunn Memorial Fund.

There have been no payments during the year, and the amount of accumulated revenue is now £9, os. 9d.

Library.

The usual list of presentations to the Library will be appended to this report.

Local Branch.

The usual reports have been received from the Aberdeen Branch, and will be appended to the report.

The Council's report was unanimously adopted.

ACCOUNTS.

The Annual Accounts were submitted by Mr Massie, Convener of the Finance Committee, and were approved.

DUNN MEMORIAL FUND.

This account was also submitted and approved.

ABERDEEN BRANCH.

The Secretary read the Report and Financial Statement of the Branch, which were approved.

ELECTION OF HON. MEMBERS.

On the motion of the PRESIDENT, the following gentlemen were unanimously elected to the Hon. Membership of the Society in recognition of their distinguished services to forestry:—
M. Paul Antoni, Sousdirecteur des Eaux et Forêts, Paris;

Colonel Pierre Buffault, Inspecteur des Eaux et Forêts, Centre de Bordeaux, France; Colonel Henry S. Graves, Chief of Forest Service, Washington, U.S.A., presently in France; Edgar C. Hirst, State Forester for New Hampshire, U.S.A.; R. G. Robinson, Department of Lands, State Forests Branch, Tapanui, Otago, New Zealand; K. A. Carlson, Orange River Conservancy, South Africa; Mr John Renwick, 9 Crosbie Street, Maryhill, Glasgow.

Election of Office-Bearers.

The Chairman, in proposing the election of the Duke of Buccleuch as President for the ensuing year, which was unanimously adopted, said:—"I have great pleasure in proposing that the Duke of Buccleuch be asked to become President of the Society for the ensuing year. It is the unanimous recommendation of the Council, and I have no doubt that it will be unanimously approved by this meeting. The Duke of Buccleuch has a double qualification for the office. He is not only one of the largest owners of woodlands in the country, and consequently bound to have a great interest in arboriculture, but he is also one of those who have in recent years made a very careful study of the subject. Indeed, I doubt whether there are many men in the country who have a greater knowledge of forestry questions than the Duke of Buccleuch. I am sure he will make an admirable President, and that we shall find him a very useful guide in the discussions that are likely to arise with regard to afforestation problems during the next year or two."

Mr Milne Home and Lord Forteviot were elected Vice-Presidents, the latter in lieu of the Duke of Buccleuch, elected President.

The following were elected Members of Council:—Messrs James Cook, John Broom, William Davidson, James Terris, D. K. M'Beath. Colonel Balfour was elected to the vacancy caused by the election of Lord Forteviot as a Vice-President.

The Hon. Secretary, the Secretary and Treasurer, the Hon. Editor, the Auditor, the Hon. Consulting Officials, and the Local Secretaries were re-elected.

The Duke of Buccleuch, having taken the Chair, said:—"I would like, in the first place, to return my thanks to you for electing me to this post. In these times it is not altogether

easy, in some ways, to fill the position, because, as you are well aware, the time at one's disposal is very much occupied, and I cannot hope to do the work in the same way in which it has been done by my predecessor. I explained my position to the Council, who were good enough to ask me to act as President, and in tendering my thanks to you for my election I can only say that I will do what I can for the Society. On this particular occasion I believe you will not want me to make any lengthy remarks, because there is a very considerable amount of business to get through, there are fewer trains than formerly, and I know many members have to get away as early as possible.

"For many years the Society has done a great deal of good practical work, but its chief work has been educative, with the object of getting people to take an interest in the question of planting. I hope the time we have been waiting for so long is at last approaching, when our activities will be directed in a practical manner to the great advantage of the country and those who are to come after us. It is quite obvious that, if it had not been for what was done in various ways by those who went before us, in piling up the wealth of this country, we would have been let down in this war. It is because of their efforts that we have been able to do what we have done, and it is only right that we should make up the deficit caused by this great strain, so that our successors may be in a similarly fortunate position. There are probably few ways in which this can be better done than by planting large tracts of the country, and even if such planting does not bring in a very good return in interest it will, at any rate, result in heaping up a mass of wealth which will belong to the nation, and at some time will be of great assistance in developing the national resources.

"Although we have had in the past a good deal, perhaps too much, of theory, it is absolutely essential that the theory should be advanced, if for one reason only. None of us in our lifetime can learn very much from personal observation of the growing of trees. In stock-breeding, for instance, or the growing of agricultural crops, we are able to get a quick return in the course of a few years, and anyone properly trained, who makes diligent use of his opportunities, can gather a good deal of knowledge from his own observation. That is impossible in silviculture, and, therefore, it is most essential that the theory

should be considered. What I have felt in the past is the difficulty of getting a sufficient number of foresters. A large number of young men have been encouraged to go to the universities and make a considerable study of forestry, but they have not had, as we know, sufficient opportunities afterwards of getting sufficient practical experience. We hope that, in the future, such men, after they have completed their university studies, will then have the best opportunities for carrying on their work in a practical manner, so that they can become as efficient as the foresters of any other country. I have no fear of the young men. They will, of course, make mistakes, but they will very soon correct them. If we can give our young men proper inducements to go into the universities and learn the theoretical side, and can then offer them proper opportunities to follow out the practical side with a career to look forward to, before very long we may become the leading nation in forestry. I think we, as a nation, have certainly as much, if not more, initiative than any other nation in the world. In this northern portion of the kingdom especially, we flatter ourselves that in most things we are tolerably practical. I feel quite confident as to the future, if we get a proper chance. These young men will be full of the keenness which comes from the prospect of a really successful career, and given fairly good financial prospects there are probably very few occupations more interesting or more pleasant than that of the forester. Before I sit down I would like to say that those who have been asked to speak on certain subjects in the course of the discussion have been requested not to exceed five minutes.

We are also fortunate to-day in having Dr Greig, of the Board of Agriculture, who has been good enough to come to our meeting. I will ask him to be kind enough to address the meeting now, because I understand he is unable to be with us in the afternoon. In again thanking you for electing me, I have only to repeat that I will do the best I can for the Society."

He then called upon Dr Greig, of the Board of Agriculture, to address the meeting.

Dr Greig said:—"I have to thank you, in the first place, on behalf of the Board of Agriculture, for giving me the opportunity of attending what, I imagine, will be regarded in the future as more or less an historical meeting of this Society. After the production of this most comprehensive and interesting Report

of the Reconstruction Committee, I do not think that we can have any fear that, in the future, forestry will be regarded with indifference by whatever Government may be in power, no matter what its political colour may be. I am certain that this particular year marks a stage in the development of forestry which we will be able to look back upon, or our children or grandchildren will, as a new start in this great industry. Every one knows, of course, that I am not a forester, and every one will understand that at this meeting I feel rather like a fish out of the water, or a pilot who is attempting to navigate without sufficient experience in some uncharted sea, but you also know that in the temporary absence, in France, of my colleague, Mr Sutherland, it became necessary, for the purpose of procedure, that someone should be the nominal head of the Forestry Division of the Board, and the Secretary for Scotland for the time being has put me nominally and technically in charge of that Division.

"The Secretary for Scotland, as you must have gathered from the different speeches he has made within the past few weeks, was not satisfied that this time, even this remarkable, exceptional, and abnormal time, was a time during which the Board of Agriculture should absolutely mark time in respect to forestry. He felt that, in spite of the difficulties and the drawbacks, in spite of the uncertainties as to what the future of forestry administration would be, it was desirable that the Board should do what it could to encourage forestry education and the general development of forestry in the meantime. But, as I say, I am not a forester, and therefore I can offer nothing to this meeting of any value from a technical standpoint. I can only report to you what, during the last month or two, the Board of Agriculture has been trying to do to carry on the work. You would have noticed, perhaps, that the Secretary for Scotland decided that it was necessary to enlarge and to strengthen the staff of the Forestry Division, and he has done so by appointing to assist the Board, Mr Gordon, who was advisory officer in Glasgow, and now we have the neucleus of a staff of which Dr Borthwick is the chief advisory officer, and of which Mr Gordon is the officer in charge of whatever scheme we can get into operation in the way of planting the land. The Secretary for Scotland has also added to the staff internally, by means of several new subordinate officers who are not necessarily technical officers.

That is one thing that has been done. And then we have been endeavouring during the past year to make a large collection of tree seeds. These seeds have been collected in two or three centres in Scotland, and they have been prepared for sowing. I am not certain whether, perhaps, we have not collected too many seeds, but that is a matter which we shall discover later. Another small activity, which was carried out originally at the suggestion of Colonel Stirling of Keir, is an attempt to find places as foresters for discharged soldiers and sailors who may not be so injured that they cannot undertake forestry work. This organisation is in full swing at present, and I am glad to say we have received numerous offers from proprietors of woodlands in Scotland to take these men on for a time on trial. We have received ten times as many offers of places as we can find men to put into them. So far all the local Pension Committees in Scotland can only produce a very few men who seem anxious to take up forestry. The objection seems partly to be that they can obtain much larger wages in some other industry, especially in munition work; but I am hopeful we may be able to find a considerable number who will take up forestry work as a career, and will become useful forestry workers in time. Then we also thought that if a large development is about to take place in the planting of Scotland, it would be desirable to have some men trained as superior workmen, foremen foresters or forest foremen, men who will be capable of supervising the work of other men. We are, therefore, proposing to inaugurate a temporary school for that class of workmen, somewhere in central Scotland. Funds will be made available for this purpose, and Colonel Fothringham of Murthly and the Duke of Atholl have offered us facilities for the training of these men, if the school should be erected in their neighbourhood. This is for the purpose of training men as working foresters, and we hope that out of the number of discharged soldiers and sailors we might succeed in obtaining a few who show such interest and intelligence that we could safely expend public money in training them to become forest foremen. We have another activity which is giving Dr Borthwick and myself a good deal of trouble, and giving him a good deal of anxiety at the moment, and that is the necessity for clearing and burning the felled areas. I am told by my advisers that it is exceedingly dangerous to leave these felled areas uncleared

and unburned because of the harbourage they give to the pine beetle and the pine weevil. The Secretary for Scotland has put at our disposal a sufficient sum of money to assist in clearing and burning many thousands of acres in co-operation with the owners of the felled areas, but, unfortunately, we are being faced by the possibility of there being no labour for the purpose. At the moment, it is quite possible that a large number of men who are presently employed in forestry work from labour battalions may be withdrawn, and if they are withdrawn it is very difficult to see where we are going to get the labour to carry out this work, and yet I understand, unless this clearing and burning is done, the prospects of forestry are very much in danger. If that is so it seems to me the first and most important question which can be tackled, and we do not propose to leave it alone. The funds are there; the thing is to get the men to do the work. We are, of course, endeavouring to organise schoolboys and women for this purpose. We have this morning got an application from seventy schoolboys to do some clearing in a felled area in Perthshire, and we have been able to make arrangements for these boys to go there during the Easter holidays. But, after all, that is a comparatively small matter, and it ought to be done on a much larger scale if it is going to be sufficiently effective.

"I think you may have heard that we have in prospect one or two schemes for the actual afforestation of land. Of course, it is not necessary for me to point out how many and how serious are the difficulties in the way of planting the land at this moment. Labour is scarce, wire for fencing is almost if not quite unprocurable, and there are other difficulties which are very hard to overcome. Nevertheless there are certain proposals made to us which we hope to carry forward to a successful conclusion. And that reminds me that the recommendation of the Forestry Sub-Committee as to proceeds-sharing seems one which should be taken up with alacrity by the landowners of Scotland. The Board some time ago, through Mr Sutherland of the Forestry Division, issued a circular pointing out the advantages of these proceeds-sharing schemes, and I understand that, owing to the war chiefly, it was difficult to take them up, but they appear to me to be on the whole a fair and reasonable way of encouraging the private owner, on the one hand, to afforest his property, and giving the State,

on the other hand, reasonable security for the money which they invest. It may be of interest if I simply sketch, as briefly as possible, three proposals now before us to indicate how elastic is the scheme and the method by which it may be carried out. One scheme which we have in hand in the North of Scotland implies that the landowner will provide the land free of rent for seventy-five or eighty years, and the Board will provide the capital for planting, for fencing, for draining, and for the maintenance and management of the forest until the end of the rotation. At the end of the rotation the proceeds will be divided according to the expenditure, to the landlord on the one hand, that is, according to the annual rental of the land plus compound interest on that rental from year to year to the end of the rotation, and on the part of the State at compound interest on the capital expenditure and the annual maintenance with compound interest thereon. At the moment it looks as if the proprietor might obtain well over one-third of the proceeds, while the Board will receive something like one-third also, and the remaining third would be divided between them according to their outputs as provided. In that scheme the landlord is practically doing nothing but provide the land. He has no interest in the management, no interest but in seeing the land planted. He does not want to take part in it himself. In this case, the Board is willing to step in and do the planting and management for him. In another case, in the West of Scotland, the proprietor is a very keen forester, largely interested in the planting of trees and who knows how to manage them, and he prefers to keep the management in his own hands. Therefore the proposal is that while the Board supplies the capital for planting the trees, the fencing and the draining, it steps out then, and the proprietor does all the rest, provides the labour, the land, the management, and takes a complete interest in the scheme, and it is carried out according to the working-plan agreed upon. At the end of the period the share of the proprietor would be very much larger. He will obtain by far the larger proportion. In a third proposal, the proprietor suggests that he should supply not only the land and the capital for planting, and for fencing and for draining and for all other purposes, but that the only contribution made should be the management by the Board's officers. You may say, 'Why does he not do all?'

Apparently the idea is that throughout a series of years the proprietor thinks he might get a more certain and a more economical management through a Government department than from a succession of foresters obtained in the ordinary way by his heirs or successors, who might not be so interested in forestry as he is himself. In that case you see the proprietor does practically everything except manage, and his share of the ultimate proceeds would be almost all the entire available sums for division. I only bring this to your notice in order that you may see how elastic this may be made. I do not say that all these schemes will eventually be carried out, because that depends upon the Treasury as much as upon any other department, but these are schemes which the Board is considering, and which the Board will be prepared to recommend for assistance from public funds.

"I do not think that I can add anything of value to the discussion of this conference to-day. I can only repeat that I am grateful for the opportunity on behalf of my Board of attending this meeting, and I trust this Society will continue to exert an active and progressive interest upon the development of forestry. It appears to me that the Society has a very great and important future before it, and I would like, if I may, to assure the Society of the interest which the Secretary for Scotland takes in forestry. I know from personal knowledge that he is enthusiastically in favour of doing whatever is possible for the development of this great industry. The Board of Agriculture in the past has been accused, I think, of indifference to forestry. If this opinion was common in a period when the Forestry Division of the Board was under the control of so able and so enthusiastic a forester as my colleague, Mr Sutherland, I am afraid that I, who am merely a *locum tenens*, can do nothing to shake that opinion. I can only assure you that the Board is not, and never was, indifferent to forestry. It has been my duty during the last month or two to endeavour to understand some of the problems of forestry, and speaking very humbly and merely as a layman, it appears to me that forestry, no matter under what administration, can only develop successfully if certain conditions are fulfilled, and that these conditions are three. In the first place, there must be a sufficient supply of public funds to encourage and assist the industry. In the second place, we must have a sufficient number

of thoroughly trained scientific forestry officers. In the third place, and perhaps this is the most important, I do not see forestry succeeding in Scotland unless it has the hearty co-operation and approval of the foresters and landowners of Scotland. It appears to me that these conditions must be fulfilled if forestry is to succeed in this country."

The Chairman.—"Before calling on Sir Andrew Agnew, it will be your wish that on your behalf I should thank Dr Greig for coming here, and should say how much we have appreciated his address."

Discussion.

Sir Andrew Agnew then opened the discussion on the Report of the Forestry Sub-Committee of the Reconstruction Committee, and moved the following resolution:—

> "That this Meeting of the Royal Scottish Arboricultural Society welcomes the publication of the Report of the Forestry Sub-Committee of the Reconstruction Committee, and urges the Government to adopt the scheme of afforestation recommended in the Report, and to bring it into operation without delay."

The following subjects dealt with in the report were then spoken upon briefly by the following members:—

1. Recommendations, by Sir Kenneth Mackenzie, Bart.
2. Forest Authority, by Sir John Stirling-Maxwell, Bart.
3. How the Scheme will affect Scotland, by Colonel Fothringham.
4. The Education and Training of Foresters, by Mr Richardson.
5. Forestry and the Education (Scotland) Bill, by Dr Borthwick.
6. Organisation of Native Timber Supplies, by Mr A. Spiers.
7. Provision of Plants and the Importance of Preparation in Advance, by Mr Massie.
8. Forestry and Small-Holdings, by Mr Gilbert Brown.
9. Social and Economic Benefits, by Colonel Balfour of Dawyck.

In the course of Sir John Stirling-Maxwell's speech upon the Forest Authority, Sir William Haldane raised the question as to whether the resolution was wide enough to cover this point. After Sir William Haldane's remarks the meeting adjourned

for lunch, and on resuming a general discussion took place. Sir Andrew Agnew read a short note by Colonel Stirling on Forestry Organisation in France.

The meeting was then thrown open for general discussion, in the course of which the need for a Central Authority was emphasised by Sir Hugh Shaw Stewart. The motion was then put to the meeting and carried unanimously. The question having been again raised as to whether the motion was sufficiently wide to cover the Central Authority, Sir Hugh Shaw Stewart suggested that a further motion should be put to the meeting making the position quite clear. It was pointed out, however, that no notice having been given of such a motion, it could only be taken up at a Special Meeting. The meeting accordingly unanimously agreed that a Special Meeting should be held, and remitted to the Council to adjust the notice and resolution.

MINUTE OF SPECIAL GENERAL MEETING of the Society held in Dowell's Rooms, 20 George Street, Edinburgh, on Friday, 15th March 1918, *at* 2.30 *p.m.*

The following fifty-four members were present:—The Duke of Buccleuch (President); Sir John Stirling-Maxwell (Hon. Secretary); Col. Stirling, M.P., Col. Balfour, Messrs Buchanan, Massie, Richardson, Allan, Macdonald, Spiers, Davidson, Forbes, Terris, J. H. Milne Home, Broom, Cook, and Curr (Members of Council); Col. Milne Home, Dr Borthwick, Sir Hugh Shaw Stewart, Sir John Gladstone, Capt. Sprot, Col. Malcolm, Capt. Stewart, Dr Shirra Gibb, Col. Fothringham, Hon. H. Dalrymple, Sir Arch. Buchan-Hepburn, and Messrs A. B. Robertson, C. W. Berry, Jas. Mann, W. E. Whyte, Donald Munro, R. C. Cowan, C. W. Cowan, E. G. Baxter, H. Brown, J. A. Holms, W. H. Menmuir, Jas. Smith, J. M'Laren, W. W. Smith, Jas. Forbes, H. M. Cadell, E. P. Stebbing, A. Hamilton, Jas. Wilson, C. J. G. Paterson, W. A. Rae, Geo. Leven, J. L. Pike, J. H. Sang, R. Inglis, and R. Galloway (Secretary).

Apologies for absence were intimated from Lord Lovat, Sir Kenneth Mackenzie, Messrs Irvine of Drum, Duthie, Whitton, M'Beath, Fraser (Members of Council); Sir Andrew Agnew, Sir James Campbell, Sir David Stewart, Major Chadwick, and Messrs J. A. Campbell, D. Thompson, T. Stark, J. Boyd, Don. Robertson, A. D. Hopkinson.

The Secretary read the notice calling the meeting as follows :—

19 Castle Street,
Edinburgh, *1st March* 1918.

SPECIAL MEETING.

At the Annual Business Meeting of the Society held on the 20th ult., the Resolution regarding the Report of the Forestry Sub-Committee of the Reconstruction Committee, which was printed in the notice calling that meeting, was unanimously adopted. A doubt was, however, expressed by one or two members as to whether the Resolution was wide enough in its terms to embrace approval of the proposed Central Forest Authority. With the view of removing any dubiety on the point Sir Hugh Shaw Stewart proposed to submit a further Motion to the meeting, but it was ruled that such a Motion required notice. The Meeting thereupon unanimously remitted to the Council to call a Special Meeting of the Society to deal with this matter.

A Special General Meeting of the Society will, therefore, be held within Dowell's Rooms, 20 George Street, Edinburgh, on Friday, 15th March 1918, at 2.30 o'clock P.M., when the following motion will be submitted for adoption, namely :—

> "That this Meeting of the Royal Scottish Arboricultural Society, specially convened, hereby approves of the recommendations of the Forestry Sub-Committee of the Reconstruction Committee, and particularly of the recommendation that a Central Forest Authority, equipped with funds and powers, be created for Great Britain and Ireland, and urges the Government to carry these recommendations into effect without delay."

By Order of the Council,

R. Galloway,
Secretary.

The Secretary also read the rule regulating the procedure.

The Chairman read the following telegram received from Lord Lovat:—"Regret military duties prevent attendance. After over a year's association with the higher officials of the French Forestry Service, and an intimate acquaintance with some thirty of their admirably managed forests, I am more than ever convinced that

if forestry is to be a success in Great Britain it must be divorced from party politics and politicians. To gain this, I see no other way except central control of finance, personnel, State forest management, education, research. In this central control I am certain Scottish foresters, from their knowledge and ability, will play their part."

The Chairman then called upon Sir HUGH SHAW STEWART who formally moved the resolution embodied in the notice. The motion was seconded by Mr ROBERT FORBES.

Mr MENMUIR proposed, as an amendment, that a Central Forest Authority be appointed in Scotland for Scotland. Mr W. E. WHYTE seconded.

Colonel Stirling and Colonel Balfour then spoke in support of the motion.

Mr STEBBING moved an amendment which was, however, ruled out of order, and he subsequently, with the consent of the Chairman, altered his amendment to a direct negative, which was seconded by Mr HAMILTON.

The following thereafter took part in the discussion, namely:— Sir John Stirling-Maxwell, Colonel Malcolm, Mr H. M. Cadell, and Mr A. D. Richardson.

With a view to meeting objectors, Sir HUGH SHAW STEWART suggested the following addition to his motion—

> "The Central Authority to use local authorities in England, Scotland, and Ireland for administrative purposes to meet local conditions."

Mr Menmuir and Mr Stebbing, however, would not accept this suggestion, and it was therefore withdrawn.

A vote was then taken on Mr Menmuir's amendment, and it was supported by only three members and was declared defeated.

Sir Hugh Shaw Stewart's motion was then put to the meeting, when forty-four members voted for it. Only one vote was given for the direct negative, and the motion was accordingly declared carried.

APPENDIX A.

ABSTRACT OF ACCOUNTS

IN CONNECTION WITH

THE MALCOLM DUNN MEMORIAL FUND, YEAR 1917.

RECEIPTS.

Balance in Bank at close of last Account . .	£6	1	9
Income Tax recovered	0	14	0
Dividend on £100 Redeemable Stock of Edinburgh Corporation, payable at Whitsunday and Martinmas, 1917, £3, *less* Tax, 15s. .	2	5	0
	£9	0	9

PAYMENTS.

Nil.

Balance carried forward, being sum in National Bank of Scotland on Account Current .	£9	0	9

EDINBURGH, *8th February* 1918.—Examined and found correct. The Certificate by the Bank of above balance, and Edinburgh Corporation Stock Certificate, have been exhibited.

ALEX. J. MUNRO,
Auditor.

APPENDIX B.

Abstract of Accounts for Year ending 31st December 1917.

8. Education Fund,						60	10 6
Payment to Account of Expense of Printing President's Book for Young People,				£60	0 0		
Fee for use of Photo for ditto,				0	10 6		
Balance at close of Accounts,						588	3 3
1. Education Fund—Balance,				£44	17 7		
2. Special Report Fund,				100	0 0		
3. Balance of Accumulated Revenue carried to next year, subject to payment of cost, etc., of January *Transactions*				443	5 8		
Note.—Balance of Revenue as above,				£443	5 8		
Less Balance at debit of Capital as above,				133	13 6		
				£309	12 2		
Education Fund as above				44	17 7		
Special Report Fund as above				100	0 0		
				£454	9 9		
On Deposit Receipt with National Bank of Scotland, Ltd.,	£440	0 0					
At credit of Account current with National Bank of Scotland, Ltd.,	10	3 3					
In Treasurer's hands,	4	6 6					
				£454	9 9		
						£1278	14 9

EDINBURGH, 28th *January* 1918.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1917, of which the above is an Abstract, and have found them correct. The Securities, representing the Funds as above, have also been exhibited to me.

ALEX. J. MUNRO, *Auditor.*

APPENDIX B.

Abstract of Accounts for Year ending 31st December 1917

I.—CAPITAL

CHARGE.			DISCHARGE.		
1. Funds at 31st December 1916,		£1129 15 9	1. Proportion of Life Members' Subscriptions transferred to Revenue,		£141 10 3
£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 96¾,	£341 5 0		*Unexhausted:* ⅞ of Full Life Subscriptions, £783 0 9	£129 17 6	
£500 Caledonian Railway Company 4 per cent. Debenture Stock, at 77½,	388 15 0		⅞ of Commuted Subscriptions, 87 17 7	20 12 9	
£400 North British Railway Company 3 per cent. Debenture Stock, at 87½,	231 16 0		2. Decrease in value of Railway Stocks since 31st December 1916,		7 5 0
£400 North British Railway Company, No. 1, 4 per cent. Preference Stock, at 74,	296 0 0		3. Funds, etc., at 31st December 1917—		
	£1247 10 0		£500 Caledonian Railway Company 4 per cent. Guaranteed Annuity Stock, No. 2, at 70½,	£351 5 0	
Furniture, etc., in Society's Room,	40 0 0		£600 Caledonian Railway Company 4 per cent. Debenture Stock, at 75,	375 0 0	
	£1287 10 0		£400 North British Railway Company 3 per cent. Debenture Stock, at 56,	224 0 0	
Less Balance at Debit of Capital,	157 14 3		£400 North British Railway Company, No. 1, 4% Preference Stock, at 74,	296 0 0	
	£1129 15 9			£1246 5 0	
2. Life Members' Subscriptions in 1917,		165 11 0	Furniture, etc., in Society's Room, say,	40 0 0	
New Members,	£155 11 0			£1286 5 0	
Ordinary Members by commutation,	7 0 0		*Less* Balance at Debit of Capital,	133 13 6	
		£1295 6 9			1146 11 6
					£1295 6 9

II.—REVENUE

CHARGE			DISCHARGE.		
1. Balances in hand at 31st December 1916,		£553 9 8	1. Printing, Stationery, etc.,		£179 12 1
2. Ordinary Members' Subscriptions,		362 4 6	Vol. XXXI. Part I. *Trans.*, Authors' Reprints,	£61 2 1 / 3 19 9	
Arrears at 31st December 1916, £54 5 0				£65 1 10	
Add Arrears written off but since recovered, 1 0 0			Vol. XXXI. Part II of *Trans.*, Authors' Reprints,	£99 13 8 / 3 16 6	
	£55 5 0			99 10 2	
Subscriptions for 1917, £401 6 6				£164 12 0	
Less Received in 1916, 5 3 0			General Printing and Stationery,	£43 12 11	
	396 3 6		Forestry Periodicals, Binding, etc.,	1 4 0	
Subscriptions for 1918 received in 1917,	4 6 6			44 16 11	
	£455 13 0			£209 8 11	
Deduct— Cancelled or written off as irrecoverable at 31st December 1917, £7 16 0			*Less* Receipts for Advts. in *Trans.* and from Authors	29 16 10	
Arrears at 31st December 1917, 85 12 6				£179 12 1	
	93 8 6		2. Prizes (Medals),		1 18 0
	£362 4 6		3. Contribution to Aberdeen Branch,		5 0 0
3. Proportion of Life Members' Subscriptions transferred from Capital,		141 10 3	4. Contribution to Scottish Council of Agriculture,		5 0 0
4. Dividends and Interest,		570 7 9	5. Fee to Reporters,		12 6 0
5. *Transactions* sold, less purchased		52 17 11	6. Expenses of Management,		269 19 10
6. Income Tax Recovered,		14 16 7	Rent of Room and Taxes for 1917, and Halls for Meetings,	£24 14 4	
7. Education Fund.—			Auditor,	3 3 0	
(1) From W. Rowan Thomson, Esq., Second Donation,	£25 0 0	30 8 1	Hon. Editor's Assistant,	30 0 0	
(2) Sales of President's Book for Young People,	3 8 0		Fee for French Notes,	5 0 0	
(3) Interest from Bank	1 10 7		Secretary and Treasurer,	126 0 0	
8. Special Report Fund—			Advertising, Insurance, and Premium on Secretary's Bond of Caution,	6 14 3	
Donation from Sir John Stirling-Maxwell, Bart.,		100 0 0	Councillors' Luncheons	7 10 6	
			Postages and Miscellaneous Outlays, viz.:—		
			Postages of Parts I. and II. of Vol. XXXI. of *Transactions*, £24 18 8		
			General Postages, Communications on Cheques, and Petty Outlays, 33 1 1		
				57 19 9	
				£259 18 10	
			7. Expenses in Action Mr C. S. Fraser against the Society,		109 5 1
			1. Expenses due by Mr Fraser,	£105 1 1	
			2. Extraordinary Expenses,	11 4 0	
			8. Education Fund,		60 10 0
			Payment to Account of Expense of Printing President's Book for Young People,	£60 0 0	
			Fee for use of Photo for ditto,	0 10 0	
			Balance at close of Accounts,		588 3 6
			1. Education Fund—Balance,	£44 17 7	
			2. Special Report Fund,	100 0 0	
			3. Balance of Accumulated Revenue carried to next year, subject to payment of cost etc., of January *Transactions*	443 5 8	
			Note— Balance of Revenue as above,	£443 5 8	
			Less Balance at debit of Capital as above	133 13 6	
				£309 12 2	
			Education Fund as above	44 17 7	
			Special Report Fund as above	100 0 0	
				£454 9 9	
			On Deposit Receipt with National Bank of Scotland, Ltd., £440 0 0		
			At credit of Account current with National Bank of Scotland, Ltd., 10 5 3		
			In Treasurer's hands, 4 6 6		
				£454 9 9	
		£1278 14 3			£1278 14 3

EDINBURGH, 28th *January* 1918.—I hereby certify that I have examined the Accounts of the Treasurer for the year to 31st December 1917, of which the above is an Abstract, and have found them correct. The Securities, representing the Funds as above, have also been exhibited to me.

ALEX. J. MUNRO, *Auditor*

APPENDIX C.

ROYAL SCOTTISH ARBORICULTURAL SOCIETY (ABERDEEN BRANCH).

REPORT 1917.

The Committee beg to submit the Twelfth Annual Report of the Branch.

The Membership of the Branch is 116, four having joined the Branch during the year.

In view of the continuance of the war, and the restricted travelling facilities, it was unanimously decided not to hold any excursions during the year, and, accordingly, only two regular meetings of the Branch have been held, one being the Annual Meeting on 9th December 1916, and the other on 16th June 1917.

At the Annual Meeting, held in December, formal business only was transacted, and at the meeting held in June, a discussion took place on "The War and its Effect on the Future of British Forestry." The discussion, which was opened by Mr C. S. France, and was taken part in by Sir Thomas Burnett of Crathes, Messrs John Rule, George Wylie, Alexander Robson, and Peter Leslie, was a useful contribution to the interests of forestry and of the Branch.

The Committee again beg to record their thanks to Professor Trail, and to the University authorities, for the use of the Botanical class-room to the Branch.

JAMES W. H. TRAIL,
President.

GEORGE D. MASSIE,
Secretary.

ABERDEEN, 14*th December* 1917.

APPENDIX D.—Royal Scottish Arboricultural Society (Aberdeen Branch).

STATEMENT OF ACCOUNTS, Year 1917.

GENERAL ACCOUNT.

INCOME.

	£	s	d
Balance at credit of last Account	10	10	9½
Subscriptions from Members at 1s.	4	17	0
Savings Bank Interest	0	4	1
Grant from Parent Society	5	0	0
	£20	11	10½

EXPENDITURE.

	£	s	d
Stationery	1	6	0
Printing	1	5	6
Postages and Incidents	1	10	0
Honorarium to Secretary for 1916	5	5	0
Transferred to Library Account	1	3	0
Balance at Credit	10	2	4½
	£20	11	10½

EXCURSION ACCOUNT.

	£	s	d
Balance at Debit	0	11	1

	£	s	d
Balance at Debit of last Account	0	11	1

LIBRARY ACCOUNT.

	£	s	d
Sum transferred from General Account	1	3	0
Balance at Debit	0	6	6
	£1	9	6

	£	s	d
Balance at Debit	1	3	0
Messrs D. Wylie & Son, per Account	0	6	0
Postages and Incidents	0	0	6
	£1	9	6

ABSTRACT.

	£	s	d
Balance at Credit of General Account	10	2	4½
Balance at Debit of Excursion Account	0	11	1
Balance at Debit of Library Account	0	6	6
	0	17	7
Balance at Credit of Branch per Savings Bank Pass Book No. 393	£9	4	9½

Aberdeen, 14*th December* 1917.—I have examined the foregoing Statement of Accounts, and have compared same with the vouchers, and find them to be properly stated and vouched, the balance at the credit of the Branch being Nine pounds four shillings and ninepence halfpenny, which sum is deposited with the Aberdeen Savings Bank, per Savings Bank Pass Book, No. C.393, which I have also seen.

Wm. WYLIE.

APPENDIX E.

Office-Bearers for 1918:—

PATRON.

His Majesty The King.

PRESIDENT.

The Duke of Buccleuch, Dalkeith Palace, Dalkeith.

VICE-PRESIDENTS.

John F. Annand, M.Sc., Lecturer in Forestry, Armstrong College, Newcastle-upon-Tyne.
Chas. Buchanan, Factor, Penicuik.
W. H. Massie, Nurseryman, 1 Waterloo Place, Edinburgh.
J. H. Milne Home, Irvine House, Canonbie.
Lord Forteviot, of Dupplin, Perth.

COUNCIL.

Hon. Life Members.

Sir Kenneth J. Mackenzie, Bart. of Gairloch, 10 Moray Place, Edinburgh.
Sir John Stirling-Maxwell, Bart. of Pollok, Pollokshaws.

Ordinary Members.

James Whitton, Superintendent of City Parks, City Chambers, Glasgow.
A. D. Richardson, 19 Joppa Road, Portobello.
Brig.-General Lord Lovat, K.T., D.S.O.
Frank Scott, Forester, Jeannie Bank, near Perth.
The Earl of Crawford, Balcarres, Fife.
Robert Allan, Factor, Polkemmet, Whitburn.
Brig.-Gen. Archibald Stirling of Keir, M.P., Dunblane.
J. A. Duthie, Nurseryman, Aberdeen.
A. MacCallum Scott, M.P., House of Commons, Westminster.
W. S. Curr, Factor, Ninewar, Prestonkirk.
Charles Robertson, Forester, Colstoun, Haddington.
Lieut.-Col. F. R. S. Balfour of Dawyck, Stobo.
Alexander Morgan, Wood Merchant, Crieff.
George Mowat, Forester, Hamilton Estates, Riccarton by Hamilton.
Peter Leslie, B.Sc., Lecturer in Forestry, Marischal College, Aberdeen.
Adam Spiers, Timber Merchant, Warriston Sawmills, Edinburgh.
George U. Macdonald, Woodbine Cottage, Peebles.
Robert Forbes, Kennet Estate Office, Alloa.
George Fraser, Dalzell Estate Office, Motherwell.
Andrew Hamilton, The Bungalow, Hairmyres, East Kilbride.
James Cook, Overseer, Arniston, Gorebridge.
John Broom, Wood Merchant, Bathgate.
William Davidson, Forester, Edgerston, Jedburgh.
James Terris, Barns House, Blairadam, Kelty.
D. K. M'Beath, Factor, Benmore, Kilmun, Greenock.

Extra Member—President of Aberdeen Branch (A. F. Irvine, of Drum, Aberdeen).

HON. EDITOR.

Dr A. W. Borthwick, 29 St Andrew Square, Edinburgh.

AUDITOR.

Alex. J. Munro, 48 Castle Street, Edinburgh.

HON. SECRETARY.

Sir John Stirling-Maxwell, Bart. of Pollok, Pollokshaws.

SECRETARY AND TREASURER.

Robert Galloway, S.S.C., 19 Castle Street, Edinburgh.

HONORARY CONSULTING OFFICIALS.

Botanist—Professor Bayley Balfour, Royal Botanic Garden, Edinburgh.

Chemist—Dr Alexander Lauder, F.I.C., 13 George Square, Edinburgh.

Cryptogamist—Dr A. W. Borthwick, 29 St Andrew Square, Edinburgh.

Entomologist—Prof. Stewart MacDougall, 9 Dryden Place, Edinburgh.

Geologist—Dr R. Campbell, Geological Laboratory, University of Edinburgh.

Meteorologist—Andrew Watt, M.A., F.R.S.E., 122 George Street, Edinburgh.

TRUSTEES.

Lieut.-Col. W. Steuart Fothringham of Murthly, Sir John Stirling-Maxwell, Bart. of Pollok, and Sir Andrew N. Agnew, Bart. of Lochnaw, Stranraer.

LOCAL BRANCHES.

Aberdeen.	Northern.
President.—A. F. Irvine of Drum, Aberdeen.	*President.*—
Hon. Secretary.—George D. Massie, Advocate, 147 Union Street, Aberdeen.	*Hon. Secretary.*—

CORRESPONDENTS RESIDING ABROAD.

The following are Correspondents residing abroad:—

Canada, .	Robert Bell, I.S.O., M.D., LL.D., D.Sc. (Cantab.), F.R.S. of Ottawa. Late Chief Geologist to Government of Canada, Ottawa.
India, . .	F. L. C. Cowley Brown, Principal, South Indian Forest College, Coimbatore, South India.
British East Africa, .	Edward Battiscombe, Assistant Conservator of Forests, Nigeri, *via* Naivasha, East Africa Protectorate.
United States of America,	Hugh P. Baker, Dean, New York State College of Forestry, Syracuse, N.Y.
Cape Colony, .	W. Nimmo Brown, M'Kenzie's Farm, Mowbray, P.O.
Western Australia,	Fred Moon, Craigian, Bighill Brook, Harren River, Manjimup.
New Zealand .	R. G. Robinson, Department of Lands, State Forests Branch, Tapanui, Otago.
South Africa .	K. A. Carlson, Orange Free State Conservancy.

PHOTOGRAPHIC ARTIST.

A. D. Richardson, 19 Joppa Road, Portobello.

LOCAL SECRETARIES.

Counties.	
	Scotland.
Aberdeen,	JOHN CLARK, Forester, Haddo House, Aberdeen.
	JOHN MICHIE, M.V.O., Factor, Balmoral, Ballater.
Argyll,	H. L. MACDONALD of Dunach, Oban.
Ayr,	ANDREW D. PAGE, Overseer, Culzean Home Farm, Ayr.
	A. B. ROBERTSON, Forester, The Dean, Kilmarnock.
Berwick,	
Bute,	WM. INGLIS, Forester, Cladoch, Brodick.
Clackmannan,	ROBERT FORBES, Estate Office, Kennet, Alloa.
Dumfries,	D. CRABBE, Forester, Byreburnfoot, Canonbie.
East Lothian,	W. S. CURR, Factor, Ninewar, Prestonkirk.
Fife,	WM. GILCHRIST, Forester, Nursery Cottage, Mount Melville, St Andrews.
	EDMUND SANG, Nurseryman, Kirkcaldy.
Forfar,	
Inverness,	JAMES A. GOSSIP, Nurseryman, Inverness.
Kincardine,	JOHN HART, Estates Office, Cowie, Stonehaven.
Kinross,	JAMES TERRIS, Barns House, Blairadam, Kelty.
Lanark,	JAMES WHITTON, Superintendent of Parks, City Chambers, Glasgow.
Moray,	
Perth,	JOHN SCRIMGEOUR, Doune Lodge, Doune.
Ross,	
Roxburgh,	JOHN LEISHMAN, Manager, Cavers Estate, Hawick.
	R. V. MATHER, Nurseryman, Kelso.
Sutherland,	DONALD ROBERTSON, Forester, Dunrobin, Golspie.
Wigtown,	JAMES HOGARTH, Forester, Culhorn, Stranraer.
	H. H. WALKER, Monreith Estate Office, Whauphill.
	England.
Beds,	FRANCIS MITCHELL, Forester, Woburn.
Berks,	W. STORIE, Whitway House, Newbury.
Derby,	S. MACBEAN, Estate Office, Needwood Forest, Sudbury.
Devon.	JAMES BARRIE, Forester, Stevenstone Estate, Torrington.
Durham,	JOHN F. ANNAND, M.Sc., Lecturer in Forestry, Armstrong College, Newcastle-upon-Tyne.
Hants,	W. R. BROWN, Forester, Park Cottage, Heckfield, Winchfield.
Herts,	THOMAS SMITH, Overseer, Tring Park, Wigginton, Tring.
Kent,	R. W. COWPER, Gortanore, Sittingbourne.
Lancashire,	D. C. HAMILTON, Forester, Knowsley, Prescot.
Leicester,	JAMES MARTIN, The Reservoir, Knipton, Grantham.
Lincoln,	W. B. HAVELOCK, The Nurseries, Brocklesby Park.
Notts,	W. MICHIE, Forester, Welbeck, Worksop.
	WILSON TOMLINSON, Forester, Clumber Park, Worksop.
Surrey,	JOHN ALEXANDER, 24 Lawn Crescent, Kew Gardens.
Warwick,	A. D. CHRISTIE, Hillside, Castle Road, Warley, Birmingham.

Counties.	
	England.
Wilts, . .	ANDREW BOA, Land Agent, Glenmore, The Avenue, Trowbridge.
York, . .	GEORGE HANNAH, Estate Office, Boynton, Bridlington.
	Ireland.
Dublin, . .	A. C. FORBES, Department of Forestry, Board of Agriculture. ARCH. E. MOERAN, Lissadell, Stillorgan Park.
King's County, *Tipperary*, .	ALEX. M'RAE, Forester, Dundrum.

APPENDIX F.

Additions to the Library since the publication of the List in Volume XXXI. Part 2.

Books.

1. *Forestry in New England.* By R. C. Hawley, M.F., and A. F. Hawes, M.F.
2. *French Forests and Forestry (Tunisia, Algeria, Corsica).* By Theodore S. Woolsey, jun., M.F.
3. *Estate Economics.* By Andrew Slater.
4. *Kew Bulletin*, 1916, 1917.
5. *Transactions of the Highland and Agricultural Society*, 5th series, vol. 29, 1917.
6. *Report of Smithsonian Institution*, 1916.
7. *New Zealand Official Year-Book*, 1916.
8. *Rural Planning and Development.* By Thomas Adams, Town Planning Adviser to Ministry of Conservation, Canada.
9. *Farm Forestry.* By Professor J. A. Ferguson, Pennsylvania State College.

Government and State Reports.

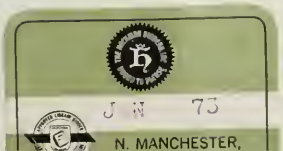
10. England:—*Report of Commissioners of H.M. Woods and Forests*, 28th June 1917.
11. India:—
    (1) *Statistics relating to Forest Administration*, 1915-16.
    (2) *Report of Forest Department of Madras*, 1915-16, 1916-17.
12. Indian Forest Bulletins:—
    (1) No. 34. *Note on Red Sanders (Prerocarpus santilinus*, Linn. f.). By T. A. Whitehead, I.F.S.
    (2) No. 35. *Note on Babul (Acacia Arabica*, Willd.). By J. T. Maitland Kirwan, I.F.S.
    (3) No. 36. *Note on Kokan or Lampatia Timber (Duabanga sonneratioides*, Ham.). By R. S. Pearson, I.F.S.
    (4) No. 37. *Note on the Contraction and Warping which takes place in* Pinus longifolia *timber while seasoning*). By R. S. Pearson, I.F.S.
13. Indian Forest Records:—
    (1) Vol. v., part 8—*Eucalyptus Oil Industry.*
    Distillation of Geranium Oil.
    Manufacture of Wintergreen Oil.
    (2) Vol. vi., part 2—*Statistics compiled by Silviculturist*, 1915-16.
    (3) Vol. vi., part 3—*Oleo-resin from* Thitsi, Melanorrhœa.
14. Australia:—
    (1) South Australia: *Report on State Forest Administration*, 1916-17.
    (2) Western Australia: *Timber Tests*, 1906. By G. A. Julius, B.Sc., M.E.
    (3) Queensland: *Report of Director of Forests*, 1916.
15. New Zealand:—*State Forest Report, year to 31st March* 1917.

16. Canada :—
    (1) *Report of Director of Forestry*, 1917.
    (2) Bulletins of Forestry Branch :
        Forest Products, 1916 : *Lumber, Lath and Shingles.*
        Pulpwood.
        Poles and Cross-ties.
        Native Trees of Canada (Bulletin 61-1917).
    (3) *Commission of Conservation : Urban and Rural Development—Report of Conference*, 1917.
    (4) *Conservation of Life.*
17. Federated Malay States :—*Report of Forest Administration*, 1916.
18. United States of America :—
    (1) Forest Service Bulletins :
        No. 460. *The Pine Trees of the Rocky Mountains.* By Geo. B. Sudworth.
        No. 497. *Tests of Western Yellow Pine Car Sills, Joists, etc.*
        No. 508. *Yields from the Destructive Distillation of certain Hardwoods.*
        No. 509. *The Theory of Drying and its application to the new Humidity-regulated and Recirculating Dry Kiln.*
        No. 638. *Forestry and Community Development.* By S. T. Dana.
    (2) Pennsylvania :—*Report of Chief Forest Fire Warden*, 1916.
    (3) California :—*Publications of the College of Agriculture.*
    (4) Maryland :—*The Forests of Maryland.* By F. W. Besley, State Forester.

Societies' and Institutions' Reports and Transactions.

19. England :—
    (1) Association of Economic Biologists. *Annals of Applied Biology*, vol. iii. No. 4 ; vol. iv. Nos. 1, 2, 3 and 4.
    (2) *Journal of the Royal Agricultural Society*, vol. lxxvii., 1916.
    (3) *Journal of the Royal Horticultural Society*, vol. xlii., parts 2 and 3.
20. Ireland :—
    (1) *Royal Dublin Society : Economic Proceedings*, vol. ii.
        No. 12. *Injurious Insects, etc., observed in Ireland*, 1914-15.
        No. 13. *Utilisation of Nitre Cake.*
    (2) *Royal Dublin Society : Scientific Proceedings*, vol. xv. Nos. 15 to 23 inclusive.
21. Scotland :—
    (1) *Transactions of the Perthshire Society of Natural Science*, vol. vi., part 4, 1916-17.
    (2) Royal Botanic Garden :—*Notes for January and March* 1917.
    (3) The Natural History Society of Scotland :—*The Glasgow Naturalist*, vol. viii. Nos. 1 and 2.

Reprints and Miscellaneous.

22. *The Trees at Mount Vernon.* By Professor Sargent.
23. Journal and Leaflets of the Board of Agriculture. London.
24. Journal of the Department of Agriculture. Dublin.
25. *Journal of Agriculture.* Victoria.
26. *The Estate Magazine.*
27. *Bulletin of Economic and Social Intelligence of the International Institute of Agriculture, Rome.* January, 1917.
28. *L'Alpe.* Firenze.
29. *Tidskrift for Skogsbrug.* Christiania.
30. *Skogsvårdsföreningens Tidskrift.* Stockholm.
31. *The Indian Forester.*
32. *Journal of Forestry.* Washington, D.C.
33. *Quarterly Journal of Forestry.* London.
34. *Canadian Forestry Journal.*
35. *American Forestry.*
36. *Handbook of the Edinburgh and East of Scotland College*, 1917-18.
37. *The Athenæum Subject Index to Periodicals*, 1916.
38. Cambridge University Library. *Report of the Library Syndicate*, 1916.
39. *Der graue Lærchenwickler als Schadling und desses Bekampfung.* By Dr Coaz.
40. *Lloyd Library Bulletins.* Cincinnati.
41. *Timber Trades Journal.*
42. *Timber News.*
43. *Revue des Eaux et Forêts.* Paris. (By purchase.)
44. *Bulletin de la Société Forestière de Franche Comté et Belfort.* (By purchase.)
45. *Allgemeine Forst- und Jagd-Zeitung.* (By purchase.)
46. *Zeitschrift für Forst- und Jagdwesen.* (,,)

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